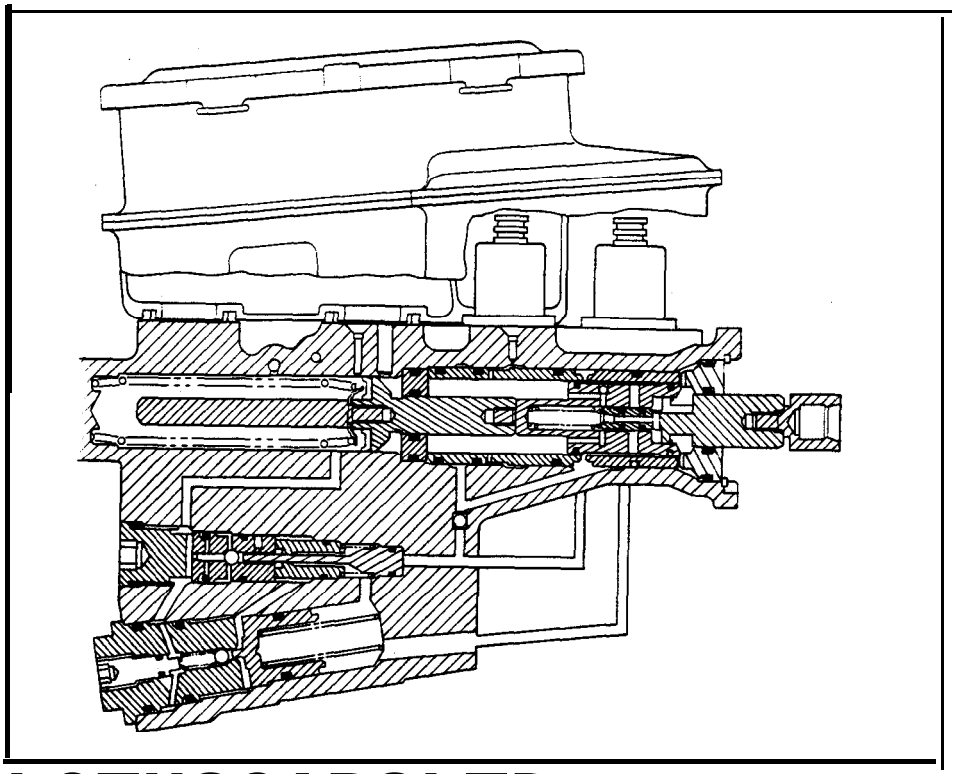
SERVICE NOTES

Section JF

Esprit '91'-'95 M.Y.

Braking System with Delco Moraine ABS IIIA



LOTUSCARSLTD

Norwich, Norfolk, Englalnd NR14 8EZ Telephone (01953) 608000 Telefax (01953) 608300

Publication Part Number G082T0327J

© Lotus Cars Ltd. August 1990.

This publication has been designed for use by Lotus Dealers familiar with general workshop safety procedures and practices. Take all appropriate action to guard against injury to persons or damage to property.

Lotus policy is one of continuous product improvement, and the right is reserved to alter specifications at any time without notice.

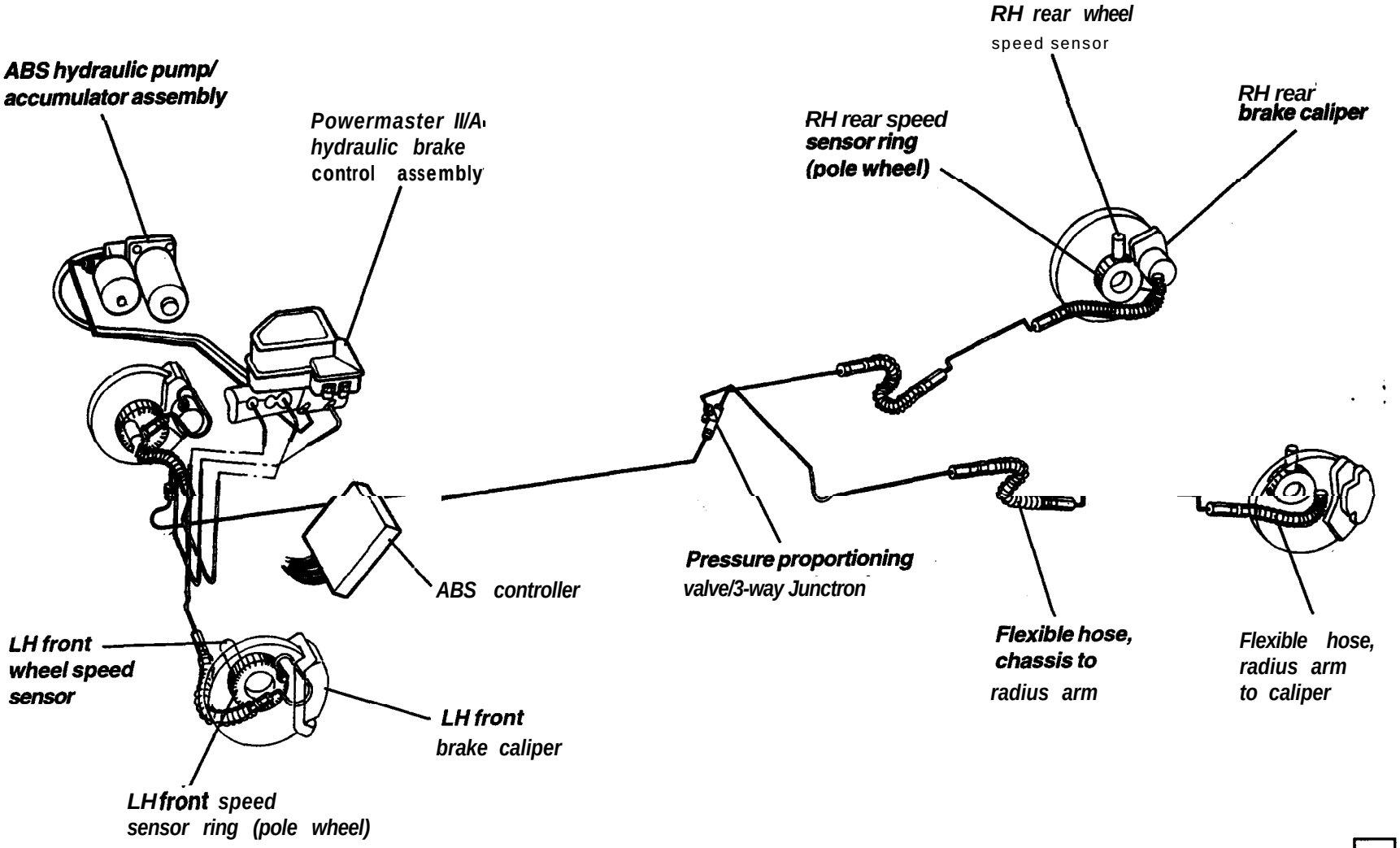
Whilst every care has been taken to ensure correctness of information, it is impossible to guarantee complete freedom from errors or omissions, or to accept liability arising from such errors or omissions, but nothing herein contained shall affect your statutory rights.

BRAKING SYSTEM [with ABS)

SECTION JF- -- ESPRIT & ESPRIT TURBO

	Sub-Section	Page
General Description	JF.I	3
Tell Tale Lamps	JF.2	4
ABS Brake Characteristics	JF.3	5
Brake Fluid Level Check	JF.4	6
Front Brake Pad Replacement	JF.5	7
Rear Brake Pad Replacement	JF.6	11
Parking Brake Adjustment	JF.7	15
Brake Bleeding Procedure	JF.8	20
Front Caliper Overhaul	JF.9	23
Rear Caliper Overhaul	JF.10	24
Brake Discs	JF.II	26
Retro-Fitment of Brembo Brakes to Esprit S4	JF.12	28
ABS Theory of Operation	JF.13	33
Hydraulic Diagnosis	JF.14	47
Brake Fluid Reservoir	JF.15	56
Solenoid Valves	JF.16	57
Booster/Master Cylinder	JF.17	59
Pump/Accumulator Assembly	JF.18	62
Wheel Speed Sensors	JF.19	65
Proportioning Valve	JF.20	67
ABS Controller, Relays, Fuses & ALDL Connector	JF.21	68
Special Tools	JF.22	70
ABS Trouble Code Diagnosis (This section is printed on cream paper)	JF.25	1

Brake System Layout


ABS hydraulic pump/ accumulator assembly
Powermaster II/A hydraulic brake control assembly
RH rear wheel speed sensor
RH rear speed sensor ring (pole wheel)
RH rear brake caliper
ABS controller
Pressure proportioning valve/3-way Junctron
Flexible hose, chassis to radius arm
Flexible hose, radius arm to caliper
LH front wheel speed sensor
LH front brake caliper
LH front speed sensor ring (pole wheel)

J68

JF.1 - GENERAL DESCRIPTION

Three variations of wheel brake have been used, all of which share a common anti-lock operating system. Prior to June '94, Esprit models used TMC front calipers and Bendix rear calipers, with ventilated front and solid rear discs. From June/July '94, Brembo calipers were used with new ventilated discs front and rear. Sport 300 models use AP Racing calipers with curved vane ventilated discs front and rear. The cable operated parking brake actuates the Esprit rear caliper pistons, or the Sport 300 dedicated handbrake calipers.

SUMMARY CHART	Esprit		Sport 300
	Prior VIN *	**From VIN ***	
3rake Manufacturer	TMC/Bendix	Brembo	A.P. Racing
Front Calipers	Single piston sliding. Behind axle.	4-piston fixed. Behind axle.	4-piston fixed. Behind axle.
Rear Calipers	Single piston sliding. Behind axle.	Single piston sliding. Behind axle.	4-piston fixed. Ahead of axle.
Parking Brake	Cable operation of rear caliper	Cable operation of rear caliper	Cable operated separate (behind axle) caliper
Front Discs	Ventilated 258 x 20	Ventilated 296 x 28	Curved vane 327 x 28
Rear Discs	Solid 275 x 12	Ventilated 300 x 22	Curved vane 280 x 28

* VIN: **Non-USA;** R 1443 (+ 1377) - July '94.1 USA; S 1391 - **June '94**

In all cases, the braking system is designed to enhance brake system performance during high speed driving, with good fade and pad wear characteristics. However, as is usual with high performance brake pad materials, the brakes do require a relatively long bedding-in period, and have a higher friction level when heated to normal working temperature, than when cold. Consequently, the brake pedal effort may feel higher during the running-in period (up to 1,000 miles) and when the brakes are cold.

The parking brake lever is mounted on the body sill and uses a balancing linkage to actuate individual cables to each rear wheel brake. Adjustment of the caliper mechanism to compensate for pad wear is automatic.

A Delco Moraine/NDH Antilock Brake System (ABS-IIIA) is used to reduce the tendency of any wheel to lose traction (lock) while braking. This feature is especially advantageous when braking on slippery road surfaces and in bad driving conditions, by aiding vehicle stability, maintaining the steering ability of the car, and in many cases reducing the stopping distance. Under normal circumstances, the hydraulic power brake system of the vehicle operates, governed by the force applied to the brake pedal. The antilock system functions only when a combination of a brake pedal switch, four wheel speed sensors and a microprocessor, determine that one or more of the wheels is losing traction during braking. The ABS-IIIA then controls the brake pressure independently to both front wheels, and to the rear wheels as a pair, to reduce the tendency of the wheel(s) to lock up.

The Powermaster IIIA hydraulic brake control assembly, incorporates a master cylinder operated by the brake pedal in the conventional manner, with power assistance provided by a pressurised supply of hydraulic fluid from a separately mounted electric pump and accumulator. Each front brake is equipped

with a separate hydraulic circuit fed from a common master cylinder chamber. The rear brake circuit is not operated by the master cylinder directly, but uses the separate pressurised hydraulic supply also used for the power assistance and ABS system. The pressure in the rear circuit is regulated by a spool valve within the master cylinder before feeding a single hydraulic line which then splits to feed each rear brake caliper. On cars with Bendix rear calipers, a pressure proportioning valve is used at the rear circuit split point in order to prevent over adjustment of the rear pads if subjected to extreme pressure.

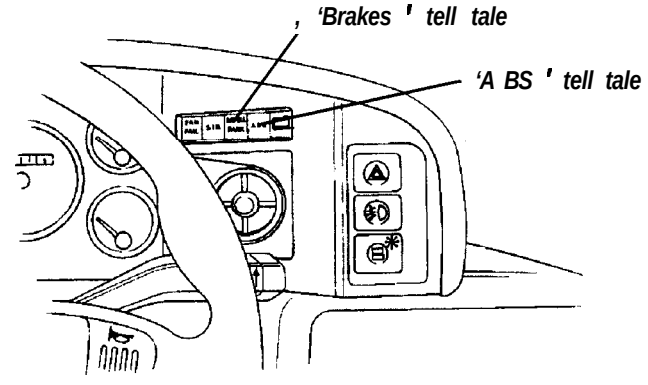
An ABS controller (microprocessor) uses a wheel speed sensor mounted at each of the four wheel hubs to continuously monitor wheel speeds when braking. If the deceleration of any wheel is too great, or its speed reletive to the other three is too low, the contoller will cycle a solenoid valve in that wheel brake's hydraulic circuit to reduce pressure and prevent wheel lock. The 'three channel, independent front, select low rear' system uses one solenoid valve in each of the two front circuits, and a single solenoid for the combined rear circuit, with the rear solenoid reacting to the behaviour of the rear wheel with least grip.

The ABS controller also monitors the system for faults, and lights a fascia mounted tell tale lamp if a fault is detected (see later).

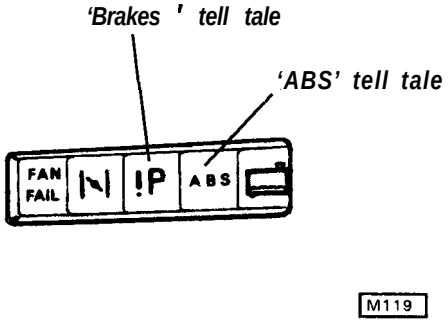
JF.2 - TELL TALE LAMPS

Two tell tale lamps are provided on the fascia to warn of problems in the brake system.

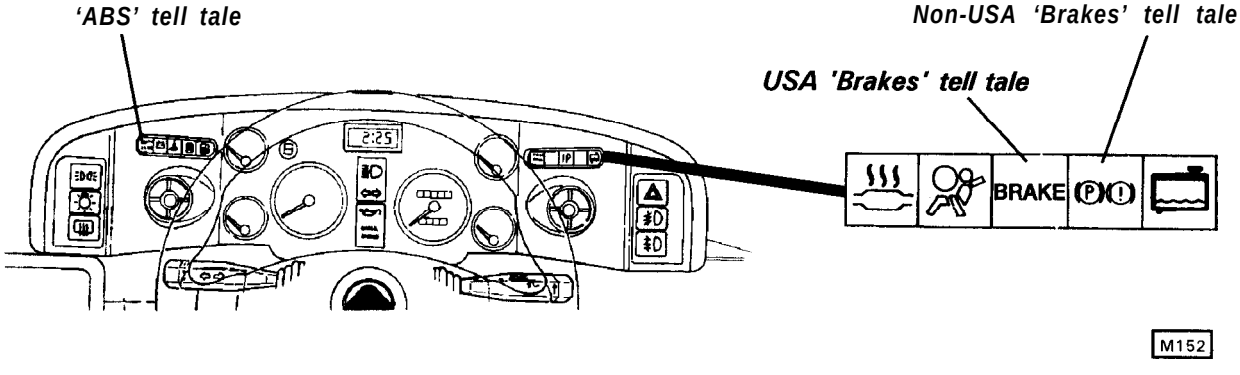
Pre '93 M.Y. USA cars



Pre '93 M.Y. non-USA graphics



'94 M.Y. onwards



Brakes Tell Tale

This tell tale will glow red with the ignition switched on, under any of the following conditions:

i) When the parking brake is applied;
ii) If the brake fluid level is low;
iii) If accumulator pressure is below 12,400 kPa (1,800 psi). If the brake pedal has been pressed several times with the ignition off, stored hydraulic pressure may fall sufficiently to activate the tell

tale. The electric pump will start up when the ignition is switched on to restore pressure, and the lamp should go out within 40 seconds.

As a bulb check function, this lamp should light when the ignition is first turned on, and go out when the engine is cranked. Under normal circumstances, with the engine idling, the tell tale should light when the parking brake is applied, and go out when released. If the lamp fails to go out when the parking brake is released, or comes on whilst driving, stop immediately as the brake fluid level or accumulator pressure may be dangerously low. Only non power assisted non-ABS braking on the front wheels may remain.

ABS Tell Tale

This amber tell tale should light for the ABS system's three second initialisation phase when the ignition is turned on. The lamp will also light in crank mode. If the lamp lights at any other time:

- a flashing light indicates that the ABS controller has detected a fault, but is still allowing full ABS operation.
  NOTE: Prolonged vehicle operation with a flashing ABS tell tale may further damage the ABS system and may cause complete ABS system failure

a continuous light indicates that the ABS controller has detected a fault and disabled part (front) or all (front and rear) of the anti-lock brake system. It will not disable the non-ABS power brake system.

JF.3 - ABS BRAKE CHARACTERISTICS

When the ignition is switched on, the ABS controller turns on the amber ABS tell tale for three seconds and cycles the solenoid valves. The clicking noise heard during this period is the solenoid operation and is quite NORMAL. If accumulator pressure is low, which normally will be the case only if the brake pedal has been operated several times since the last ignition cycle, the pump may be heard to start up and run for up to 60 seconds.

Normal braking occurs when the road conditions allow for the retardation required (controlled by pedal effort) to be achieved without danger of wheel lock. In these conditions, the Powermaster IIIA booster/master cylinder assembly uses modulated fluid pressure from the pump/accumulator to operate the rear brakes and provide power assistance to the front brakes master cylinder. If the ABS controller detects, from the wheel speed sensors, that one or more of the wheels is tending to lock, it will cause the solenoid valves to control the pressures in the relevant brake circuits. This will result in the brake pressures being modulated in cycles of apply and release (increase and decrease of pressure) until either the vehicle comes to rest, or the tendency of the wheels to lock ceases. The latter may be due to an improvement in road conditions or a reduction in pedal pressure. Whilst this cycling is taking place, the driver will notice a pulsating effect at the brake pedal as the pressure is modulated, and may also hear the solenoid valves clicking on and off. These signals indicate to the driver that maximum retardation is being approached, and that driving style should be modified to suit the conditions.

If the brakes are held moderately applied and then the ignition is switched on, these pulsations may be felt through the brake pedal as the initialisation process takes place and the solenoid valves are cycled for a few seconds. This is NORMAL and is an indication that the ABS is functioning correctly.

To minimise stopping distance using the ABS facility, the driver should steadily and firmly apply the brake pedal and allow the system to modulate hydraulic pressure. The driver should not attempt to 'pump' the brakes manually. During ABS operation, the wheels may appear to lock momentarily as the wheel speed changes rapidly, and some tyre noise (intermittent screeching) may be heard. This noise is NORMAL and will vary with road and tyre conditions. However, a wheel that completely locks and stays locked for more than one or two seconds is not normal, and indicates that the vehicle should be serviced as soon as possible. ABS IIIA cannot operate properly if the base brake system is faulty. Dragging brakes, faulty wheel bearings or other faults may not allow proper ABS operation.

Pedal Travel

When the vehicle is stopped and the ABS system is pressurised, continuous heavy pedal pressure will result in the pedal falling very slowly to near the floor. This is NORMAL. Excessive pedal travel does

exist however, if braking action does not begin until after the first 35 mm (1.4 in) of pedal movement while the system is pressurised.

With the ABS system de-pressurised (ignition off, pedal firmly applied 40 times), light pedal pressure should not result in pedal movement of more than.
55 mm (2.2 in).

Tn o w

If, in an emergency, the car is being towed, the ignition should be switched on to energise the pump and provide front brake power assistance and rear wheel braking. Without ignition, only unassisted front wheel braking will be available.

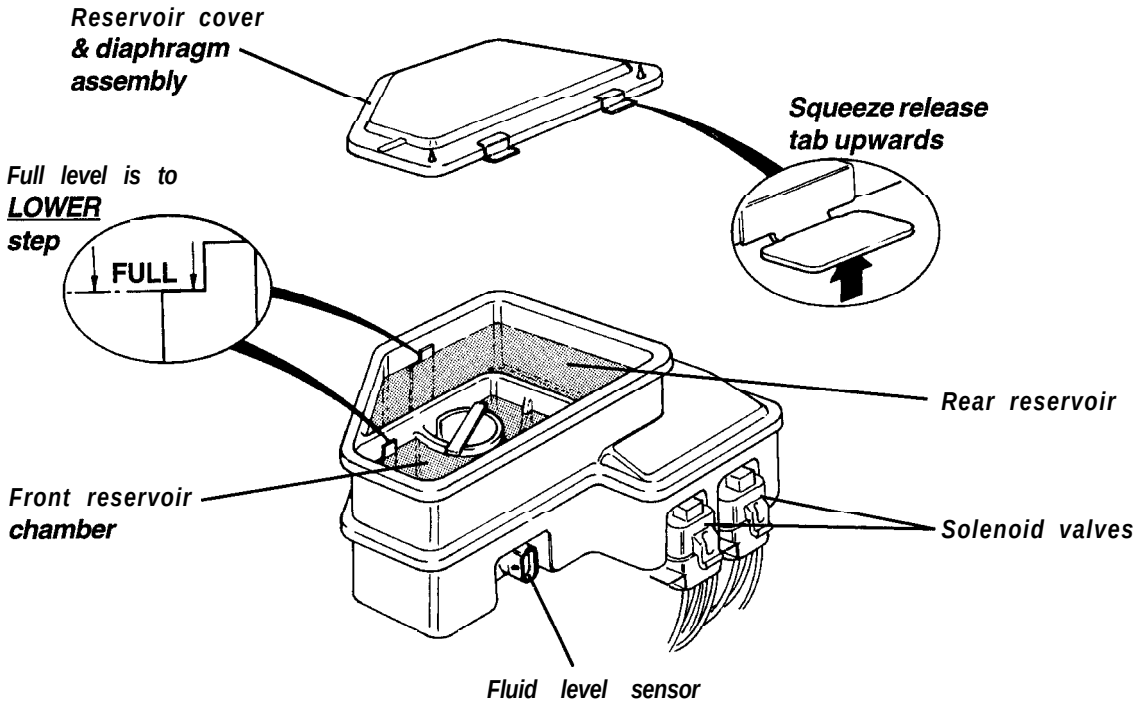
JF.4 · BRAKE FLUID LEVEL CHECK

The brake fluid reservoir is fitted on the booster/master cylinder unit in the front luggage compartment. To check the fluid level proceed as follows:

1. Park the vehicle on a level surface.

2. **IMPORTANT: De-pressurise the accumulator.** Always de-pressurise the accumulator before performing any service operations. When the system is pressurised, most of the fluid is stored in the accumulator, and the reservoir level is correspondingly low. Topping up the reservoir in this condition will result in overfilling. Although the fluid reservoir is not under pressure, if the brake pedal is operated when the reservoir cover is removed and the system is pressurised, returning brake fluid may spray from the reservoir.
   To de-pressurise the accumulator:
   Turn off the ignition.
   FIRMLY apply and release the brake pedal up to 40 times. A noticeable change in brake pedal feel (to a hard pedal with extended initial travel) will occur when the accumulator is completely discharged.

3. Clean the reservoir cover and top of the reservoir before squeezing the release tabs and lifting off the cover and diaphragm assembly.



J41

4. Check the fluid level in both front and rear chambers of the reservoir. The full level is to the lower step mark moulded on the inside wall of the reservoir.
NOTE: On initial assembly of the boester/master cylinder, the insertion of components is eased using a lubricant which is subsequently washed out of the seals by the brake fluid. This may cause the fluid to appeat as a grey emulsion, especially in the rearmost section. This is quite normal and should cause no concern. The formation of brake fluid droplets on the underside of the reservoir lid diaphragm should not be confused as being condensation.

5. If either chamber level is low:
Examine the system carefully for signs of leakage, and repair as necessary.
Use only non-mineral type DOT 4 brake fluid from a sealed container marked with a yellow and black symbol. Do not use DOT 5 silicone symbol fluid, or any fluid which has been exposed to the atmosphere for more than a brief period, or any fluid suspected of being wet, dirty or contaminated.
- Fill or top up until the levels in both chambers are aligned with the full marks.
Refit the reservoir cover and diaphragm assembly.

6. If a reservoir chamber is found to be overfilled:
- Correct the fluid level.
Install the cover and diaphragm assembly.
- Turn on the ignition and allow the system to pressurise.
Depressurise the accumulator (see above), remove the reservoir cover and re-check fluid levels.
- , If a reservoir chamber is again found to be overfilled, refer to 'Hydraulic Diagnosis'.

JF.5 - FRONT BRAKE PAD REPLACEMENT

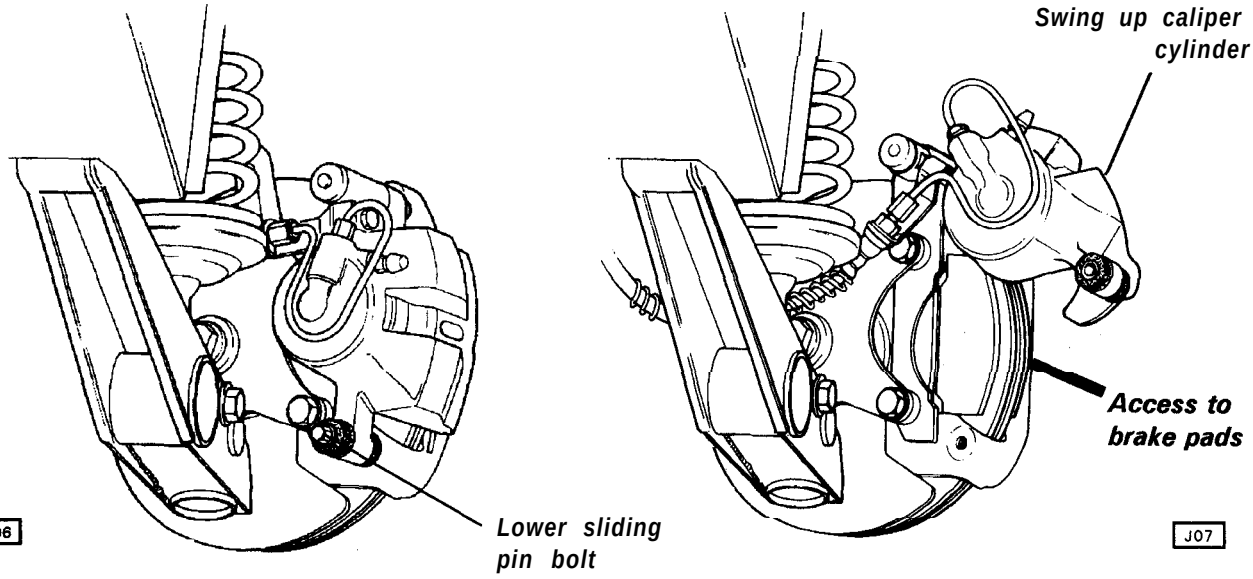
Pad thickness may be checked without disturbing the caliper.

Standard pad thickness;	- TMC Calipers (prior June/July '94);	10.5 mm
	- Brembo Calipers (June/July '94 on);	9.0 mm
	- A.P. Racing (Sport 300);	15.0 mm
Minimum pad thickness;		2.5 mm

NOTE: If the pads are to be renewed, fluid may need to be removed from the master cylinder reservoir when the caliper pistons are retracted. Before the fluid level can be established, the accumulator must be de-pressurised to return fluid from the accumulator to the reservoir. This must be done before the pads are removed; turn off the ignition and FIRMLY apply and release the brake pedal up to 40 times until the pedal feel goes hard.

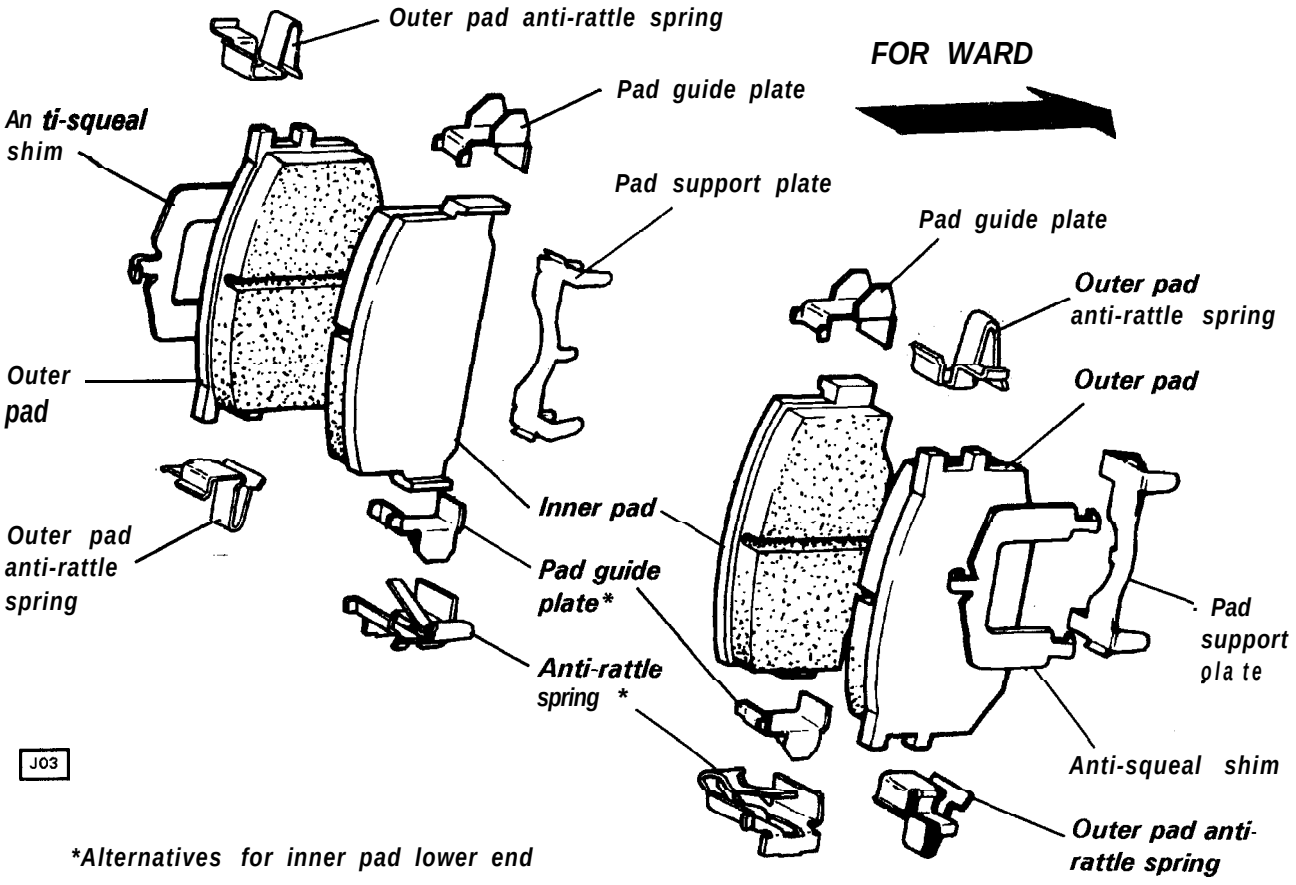
Front Pad Replacement - TMC Front Calipers (Prior June/July '94)

1. **Remove the bolt from the caliper lower sliding pin, and raise the caliper assembly,** turning the steering as necessary to avoid straining the flexible hose, to provide access to the pads.



2. Slide out both brake pads. Referring to the illustration remove each anti-rattle spring/guide plate/ support plate ONE AT A TIME, and replace with the new item supplied with the new pad set.

NOTE: Pay special attention to the correct assembly of anti-rattle'springs and pad guide plates to the caliper. Most of these are handed. Refer to the illustration below.



3. Before fitting new pads the pistons must be pushed back into the caliper. Take care not to damage the surface of the brake discs, or the piston rubber boots.

4. Fit the anti-squeal shim to the outer pad and insert into the caliper, ensuring that the anti-rattle spring tongues are tucked into the brake pad backplate slots. Insert the inner pad into the caliper.

5. Lower the caliper cylinder, and secure with the lower sliding pin bolt, torque tightening to 16 - 24 Nm (12 - 17 lbf.ft.)

6. Before driving the car, press the brake pedal several times to bring the pads to their correct running position. Before switching on the ignition, check the brake fluid level in the reservoir, and top up if necessary.

7. Ensure the customer is made aware that maximum braking efficiency will be achieved if, for the first few hundred miles, needless heavy braking is avoided, and the brake pads are allowed to 'bed in' fully before being used to their full potential.

F ont Pad Replacement - Brembo Front Calipers (June/July '94 onwards)

1. Remove the front road wheels. At each front caliper:

2. Using a hammer and suitable small diameter drift, knock out the lower pad retaining pin towards the inside. Remove the pad spring clip, and knock out the upper retaining pin.

3. Withdraw the pads and measure the lining thickness. Renew the axle set of pads if any lining thickness is below 2.5 mm.

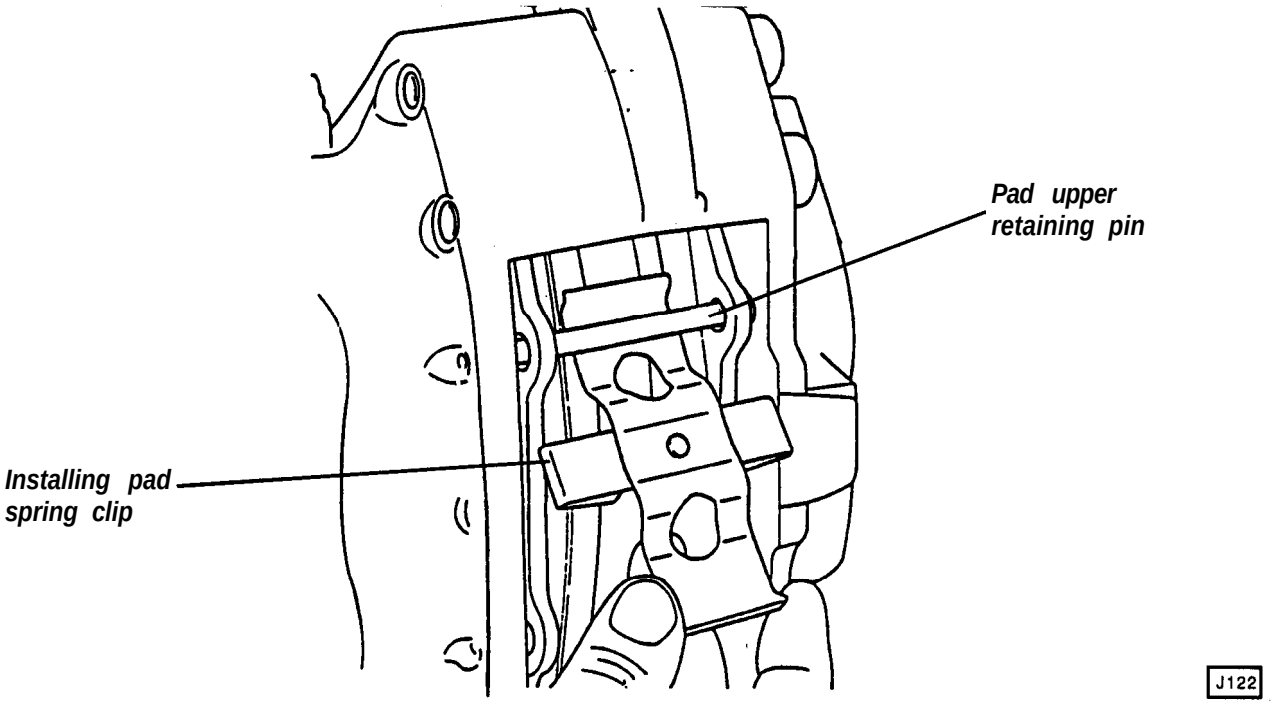
4. Before refitting the pads, inspect the piston boots for splits, cracks or other damage, and for any signs of fluid leakage or wetness. If any of these symptoms are evident, a new caliper should be fitted.

5. If refitting the existing brake pads, refit each pad in the same position as originally fitted.

6. Before fitting new pads the pistons must be pushed back into the caliper. Take care not to damage the surface of the brake discs, or the piston rubber boots.

7. Instal the brake pads into the caliper, and fit the top retaining pin from the inboard side until the small end of the pin is engaged in the outboard caliper half.

8. Hook one end of the pad spring clip under the upper retaining pin, and press down the other end whilst the lower pin is inserted. Use a pin punch to ensure that both pad retaining pins are fully installed such that the pin retaining rings are locked into the caliper bores. Check that the spring clip is centred in the caliper aperture and is preloading both brake pad backplates.



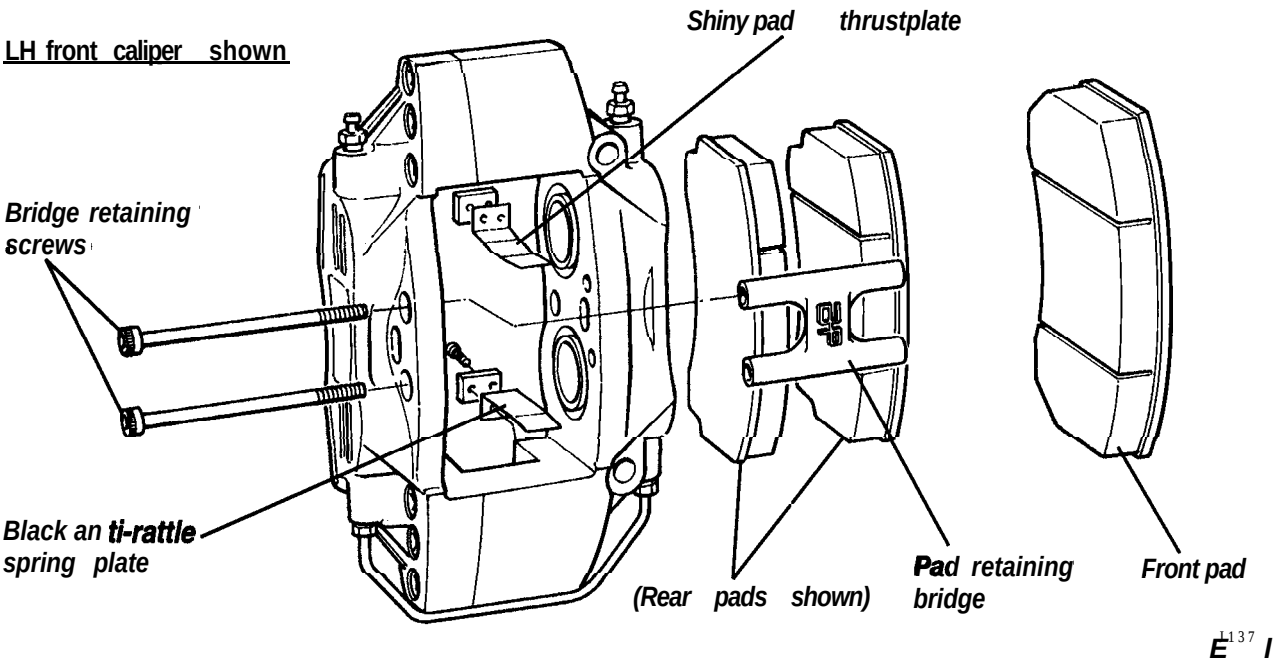
9. Refit the road wheels and press the brake pedal several times to set the brake pad position. Before switching on the ignition. check the brake fluid level in the reservoir, and top up if necessary.

10. Ensure the customer is made aware that maximum braking efficiency will be achieved if, for the first few hundred miles, needless heavy braking is avoided, and the brake pads are allowed to 'bed in' fully before being used to their full potential.

Front Pad Replacement · A.P. Racing Front Calipers (Sport 300)

1. Remove the front road wheels. At each front caliper:

2. Release the two socket head screws and remove the pad retaining bridge.



3. Withdraw the brake pads, noting their fitted positions, and measure the lining thickness. Renew the axle set of pads if any lining thickness is below 2.5 mm.

4. Before fitting new pads the pistons must.be pushed back into'the caliper. Take care not to damage the surface of the brake discs or pistons.

5. Before fitting the pads, examine the pad thrust plates (shiny) fixed at the top end of the pad recess in the caliper, and the anti-rattle spring plates (black) at the bottom end of the recess. Also examine for any signs of fluid leakage or corrosion from or around the pistons, pipe connections and joints.

6. If refitting the original pads, fit in their original positions. Otherwise fit the new pads and retain with the bridge piece. Fit and securely tighten the bridge retaining screws.

7. Refit the road wheels and press the brake pedal several times to set the brake pad position. Before switching on the ignition, check the brake fluid level in the reservoir, and top up if necessary.

Maximum braking efficiency will be achieved if, for the first few hundred miles, needless heavy braking is avoided, and the brake pads are allowed to 'bed in' fully before being used to their full potential.

:.6 REAR BRAKE PAD REPLACEMENT

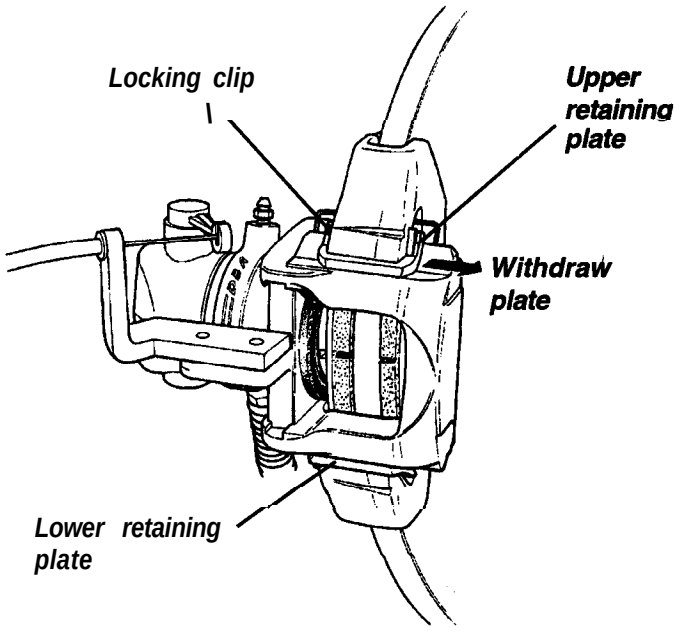
Pad thickness may be checked without disturbing the caliper.

Standard pad thickness;	· Bendix Calipers (prior June/July '94);	9.5 mm
	· Brembo Calipers (June/July '94 on);	9.5 mm
	· A.P. Racing (Sport 300);	11.0 mm
Minimum pad thickness;		**2.5** mm

NOTE: If the pads are to be renewed, fluid may need to be removed from the master cylinder reservoir when the caliper pistons are retracted. Before the fluid level can be established, the accumulator must be de-pressurised to return fluid from the accumulator to the reservoir. This must be done before the pads are removed; turn off the ignition and FIRMLY apply and release the brake pedal up to 40 times until the pedal feel goes hard.

Rear Pad Replacement - Bendix Rear Calipers (prior June/July '94)

1. At each rear caliper: Pull out the locking clips from both caliper retaining plates. Using a pin drift, drive out one retaining plate, and then remove the other plate.

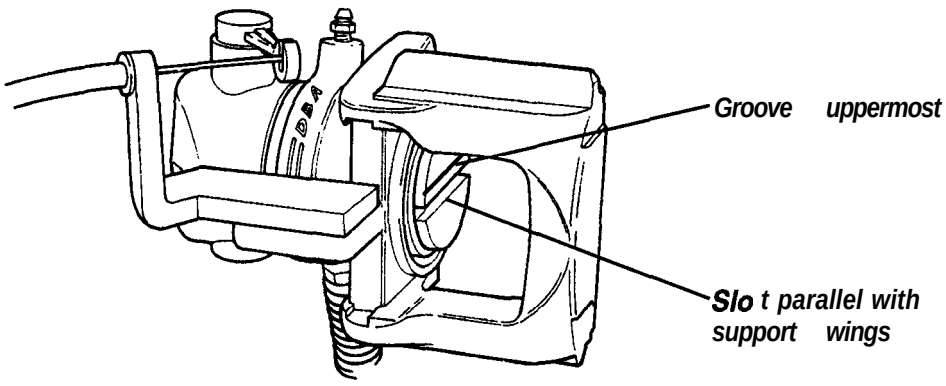


J02

2. Withdraw the caliper from the caliper mounting plate and brake pads, and support clear without stressing the flexible hose. Remove the brake pads and anti-rattle springs.

3. Before fitting new pads, it is necessary to retract the caliper piston in its bore. To retract the piston, use a l/4" drive ratchet in the slot of the piston to screw the piston clockwise down its handbrake adjuster mechanism. Take care that the fluid reservoir does not overflow during this operation. When fully retracted, screw out again until the slot is parallel with the two support wings, and the groove is toward the bleed nipple (upper) side of the cylinder as shown.

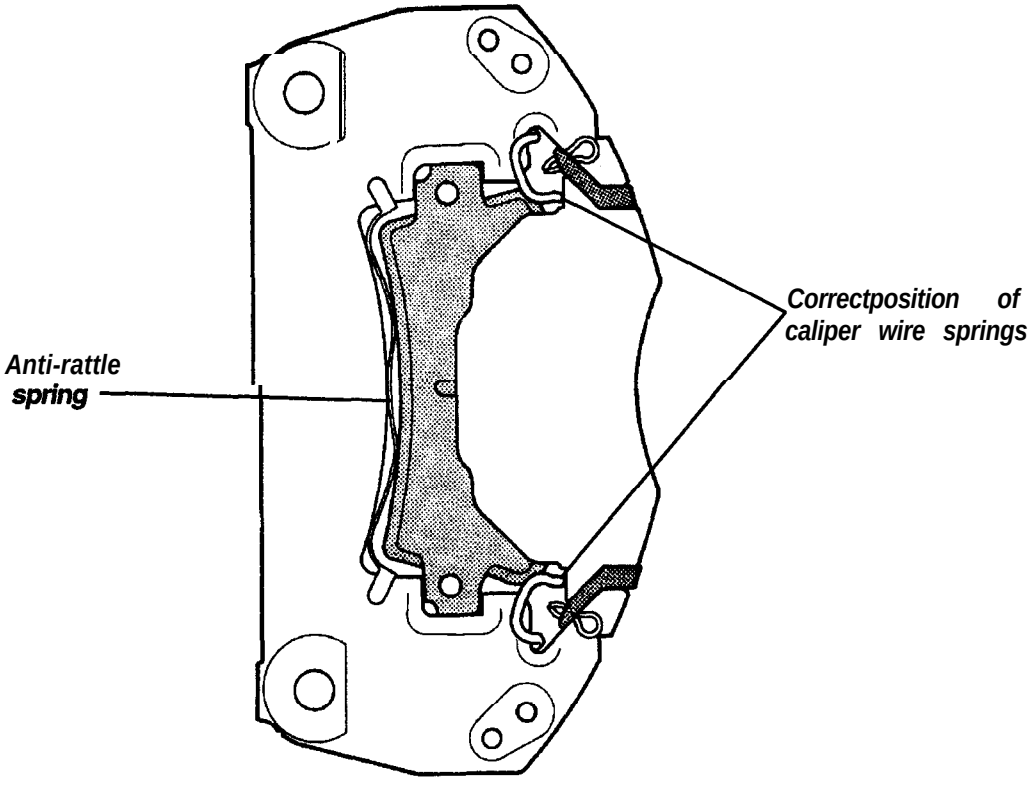
Riaht Hand Rear Caliper Shown



J04

4. Fit the brake pads, with their anti-rattle springs into the caliper bracket.

5. Refit the caliper over the pads ensuring that the caliper wire springs are located correctly, and slide in both retaining plates. Fit the locking clips.



J09

6, Press the brake pedal several times to set the brake pad position and to take up the parking brake adjustment. Before switching on the ignition, check the brake fluid level in the reservoir, and top up if necessary.

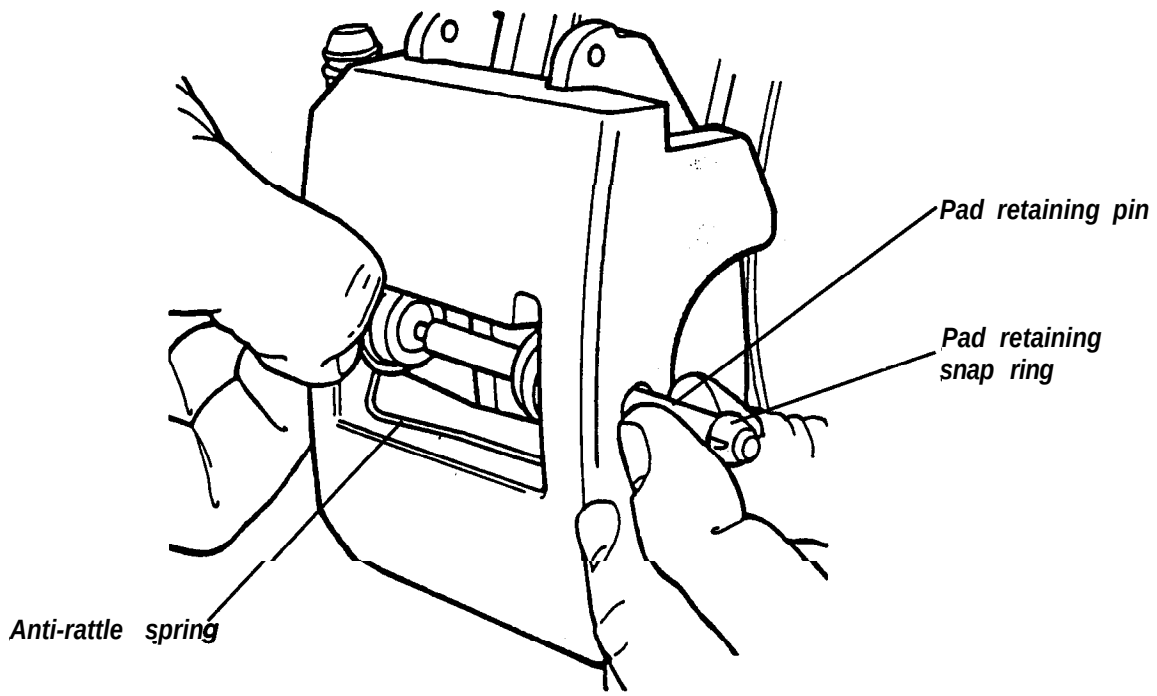
7. Ensure the customer is made aware that maximum braking efficiency will be achieved if, for the first few hundred miles, needless heavy braking is avoided, and the brake pads are allowed to 'bed in' fully before being used to their full potential.

Rear Brake Pad Replacement - Brembo Rear Calipers (June/July '94 onwards)
Tools Required: Piston Retraction Tool TOOOT1242

1. Remove the rear road wheels.

2. At each rear corner: using a suitable pin punch, knock the pad retaining pin out of the caliper towards the outside.
WARNING: Take precautions as necessary to restrain the anti-rattle spring from flying off as the pin is withdrawn.

3. Remove the anti-rattle spring, and withdraw both brake pads from the caliper. Measure the thickness of the lining material, and renew the axle set of pads if any are below 2.5 mm.



J123

4. Before refitting the pads, inspect the piston boot for splits, cracks or other damage, and for any signs of fluid leakage or wetness. If any such signs are apparent, the complete caliper should be replaced as Brembo do not recommend that this caliper be dismantled.

5. If refitting the existing brake pads, refit each pad in the same position as originally fitted.

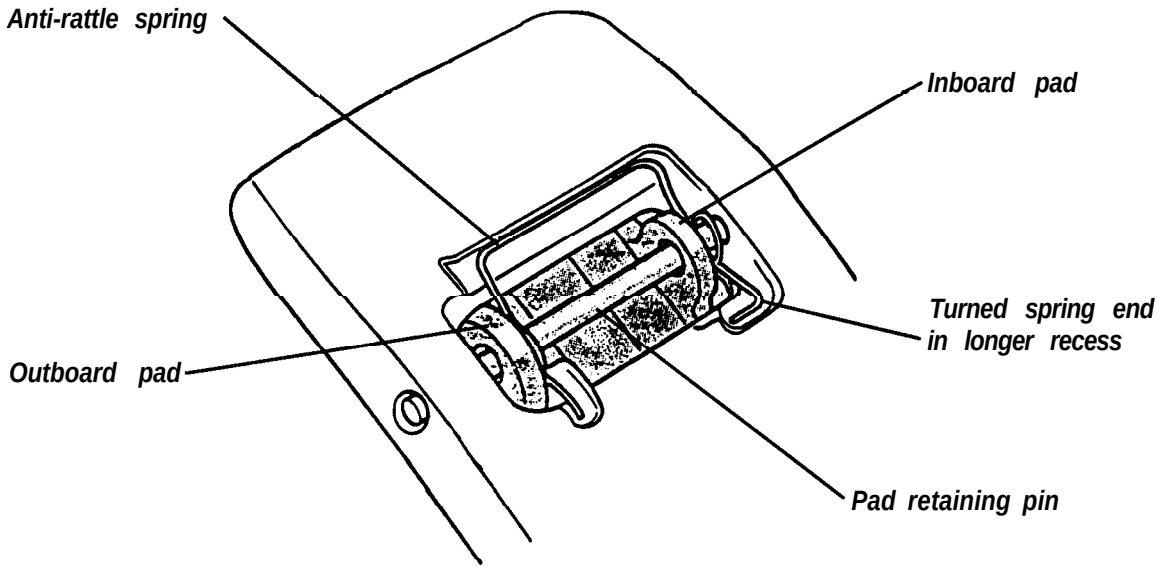
6. Before fitting new rear pads, the caliper piston must be screwed back into the caliper down the parking brake actuation mechanism. This operation requires the use of special tool TOOOT1242 and the removal of the brake disc:

Remove the single socket head screw retaining the brake disc, and remove the disc.

Fit special tool TOOOT1242 into the holes in the caliper piston, and screw the piston back down

the parking brake mechanism screwthread until fully bottomed.
Refit the brake disc, and tighten the countersunk retaining screw to 12 Nm.

7. Slide the brake pads into the caliper. Position the pad anti-rattle spring in the caliper aperture, with the spring ends located in the recesses provided. Ensure that the spring is fitted the correct way up, with the turned spring end in the longer recess. Press the spring eyes into alignment whilst the pad retaining pin is inserted through the caliper from the outside. Ensure that the pin passes through both eyes of the anti-rattle spring, and both brake pads, and that the pin is fully installed with the snap ring seated in the outboard side of the caliper.



8. Refit the roadwheels and press the brake pedal several times to set the brake pad position. Before switching on the ignition, check the fluid level in the reservoir and top up if necessary.

9. Ensure the customer is made aware that maximum braking efficiency will be achieved if, for the first few hundred miles, needless heavy braking is avoided, and the brake pads are allowed to 'bed in' fully before being used to their full potential.

Rear Brake Pad Reoiacement • A.P. Racing Rear Calipers (Sport 300)

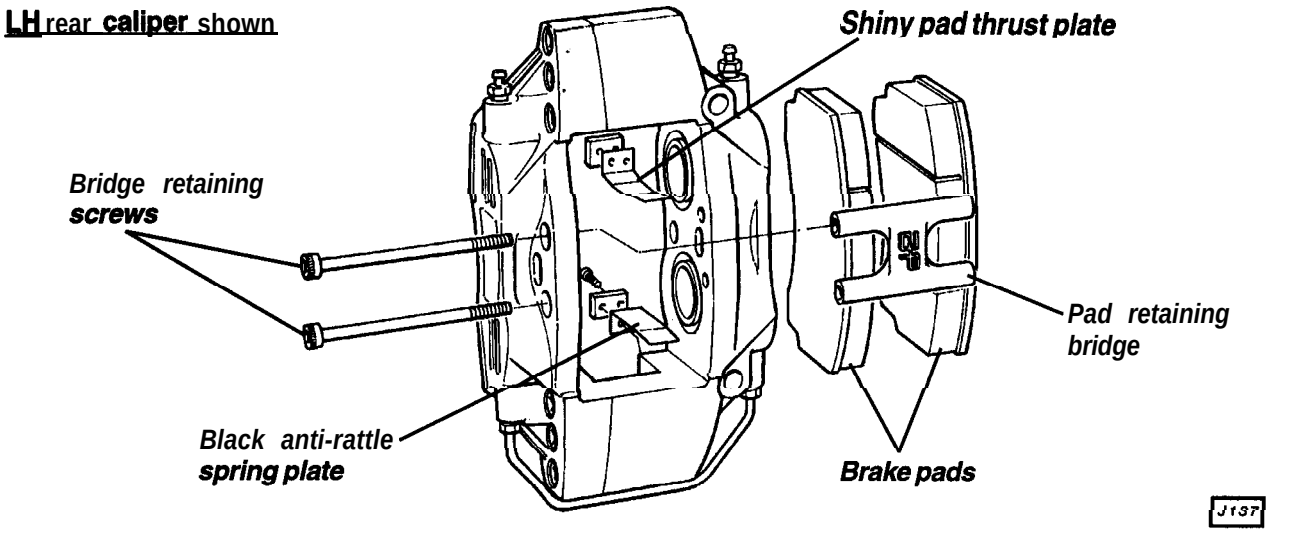
1. Remove the rear road wheels. At each rear caliper:

2. Release the two socket head screws and remove the pad retaining bridge.

3. Withdraw the brake pads, noting their fitted positions, and measure the lining thickness. Renew the axle set of pads if any lining thickness is below 2.5 mm. if refitting the used pads, instai in their original positions.

4. Before fitting the pads, examine the pad thrust plates (shiny) fixed at the bottom end of the pad recess in the caliper, and the anti-rattle spring plates (black) at the top end of the recess. Also examine for any signs of fluid leakage or corrosion from or around the pistons, pipe connections and joints.

5. if new pads are to be fitted, the pistons must be pushed back into the caliper. Take care not to damage the surface of the brake discs or pistons.



6. Insert the pads into the caliper, and retain with the bridge piece. Fit and securely tighten the bridge retaining screws.

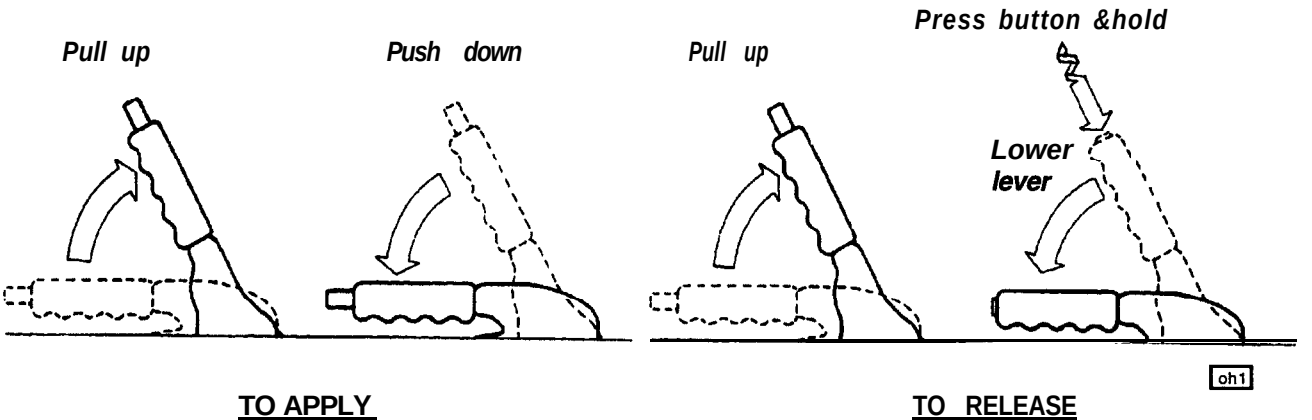
7. Refit the road wheels and press the brake pedal several times to set the brake pad position. Before switching on the ignition, check the brake fluid level in the reservoir, and top up if necessary.

6. Ensure the customer is made aware that maximum braking efficiency will be achieved if, for the first few hundred miles, needless heavy braking is avoided, and the brake pads are allowed to 'bed in' fully before being used to their full potential.

JF.7 • PARKING BRAKE ADJUSTMENT

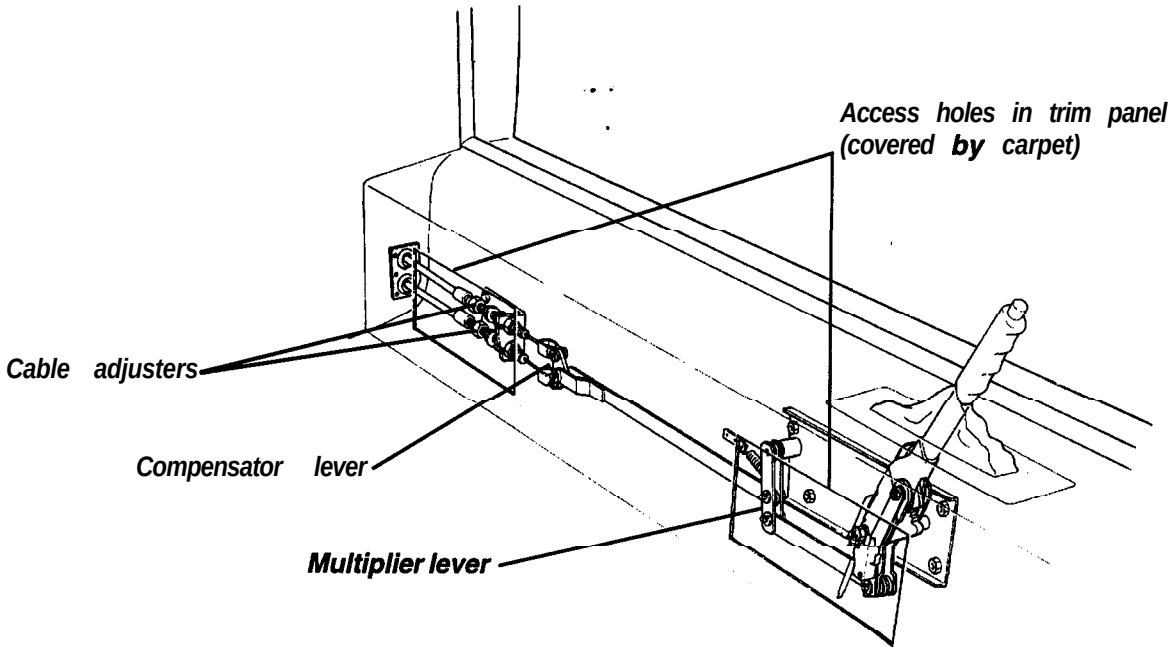
It is feature of the mechanically operated parking brake mechanism, that a large amount of parking brake lever travel is required in order for the brake to work efficiently and for the automatic adjustment to function. For this reason, a 'fold down' type parking brake lever is used to ease driver entry/exit.

The brake is applied by pulling the lever upwards in the usual manner. After application, the lever may be pushed down again (WITHOUT pressing the release button in the end of the handgrip) whilst the fascia tell tale lamp warns of parking brake application. To release the brake, pull the lever up, press the release button and HOLDING THE BUTTON PRESSED IN, lower the lever fully.



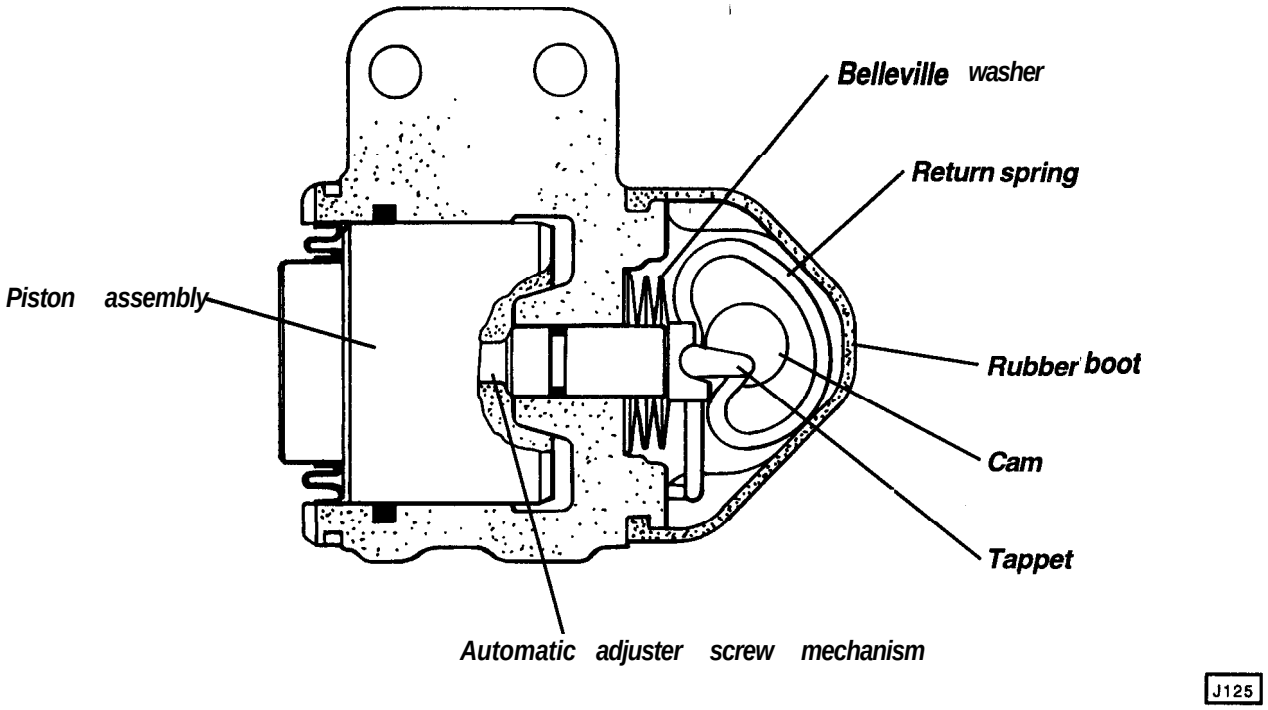
TO APPLY **TO RELEASE**

The parking brake lever is connected via a short link to a multiplier lever to increase leverage and reduce operator effort. The multiplier lever connects to an actuating link which uses a compensator lever to balance the force applied to each parking brake cable.



Parkina Brake Mechanism - Bendix

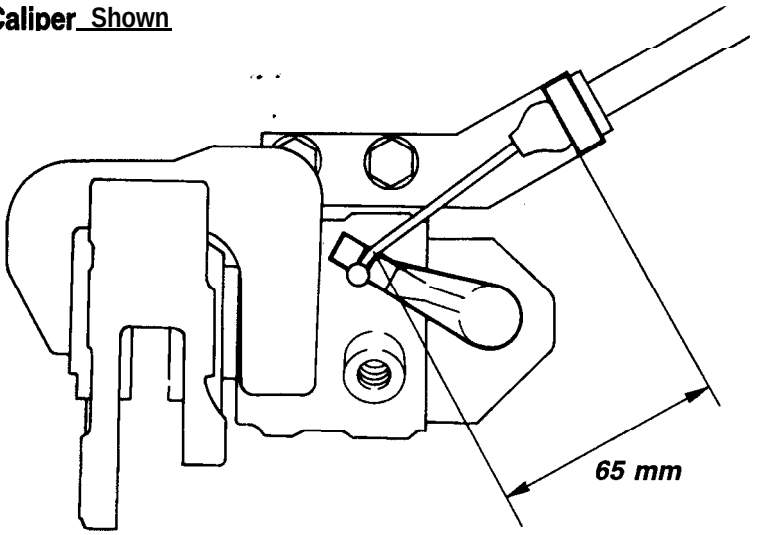
At each caliper, the parking brake cable is attached to a lever which rotates a shaft across the back of the caliper cylinder. A cam on this shaft uses a pawl to transmit rotation of the shaft into an axial movement of a pin which operates the caliper piston to apply the brake pads.



A screw thread mechanism links the pin to the piston, and automatically compensates for brake pad wear by rotation of the nut within the piston when the footbrake is applied. For the auto adjustment system to function correctly, it is essential that each caliper parking brake lever is allowed to return fully when the brake is released, and is not prevented from doing so by maladjustment of the parking brake cable.

To check that this condition is achieved, with the parking brake 'off', measure the distance between the cable abutment and caliper lever as shown.

Riaht Hand Rear **Caliper** Shown

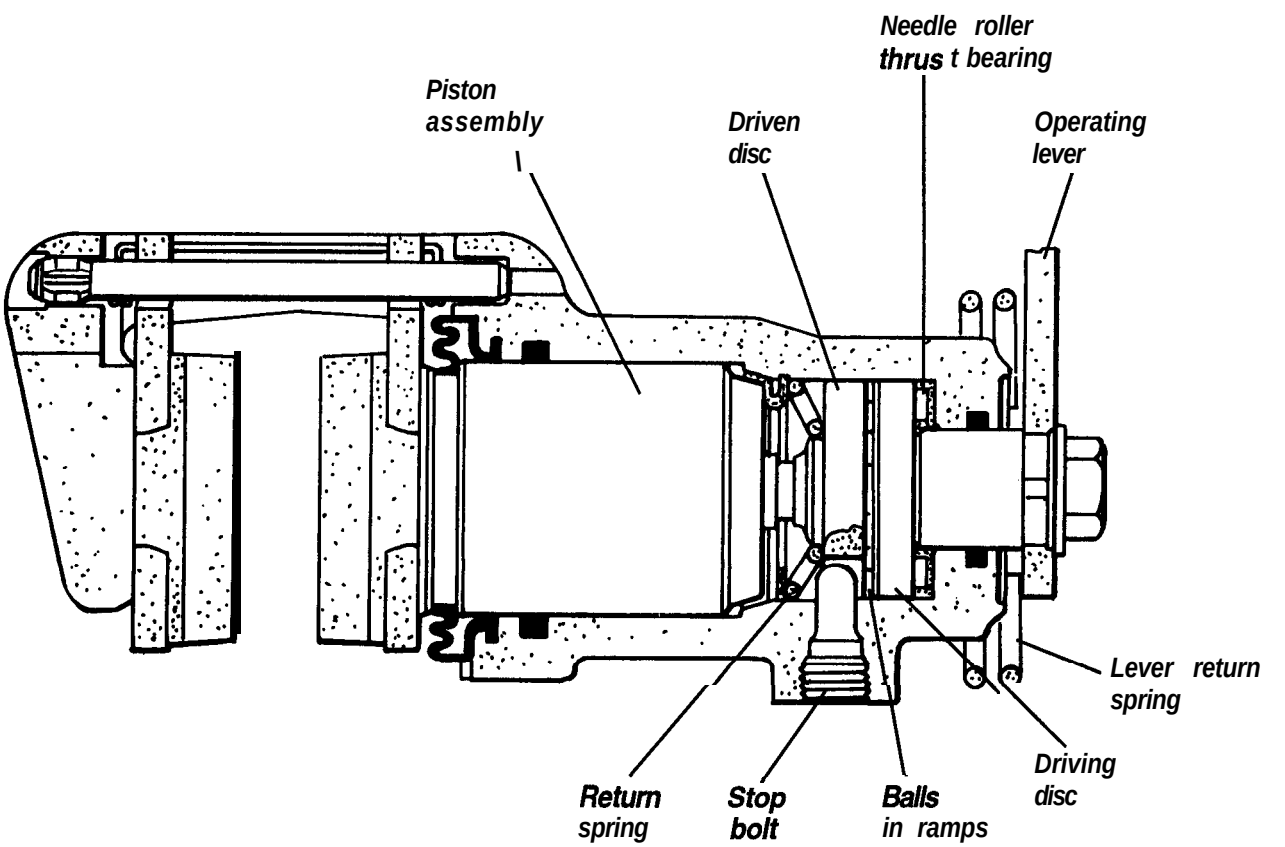


J10

After verifying this dimension, any slack in the cables may be adjusted out at their forward abutment inside the driver's sill trim panel. For access, slide the driver's seat fully forward and lift the rear end of the sill carpet to expose the trim panel aperture. After adjustment, recheck the caliper lever 'off' dimension as above.

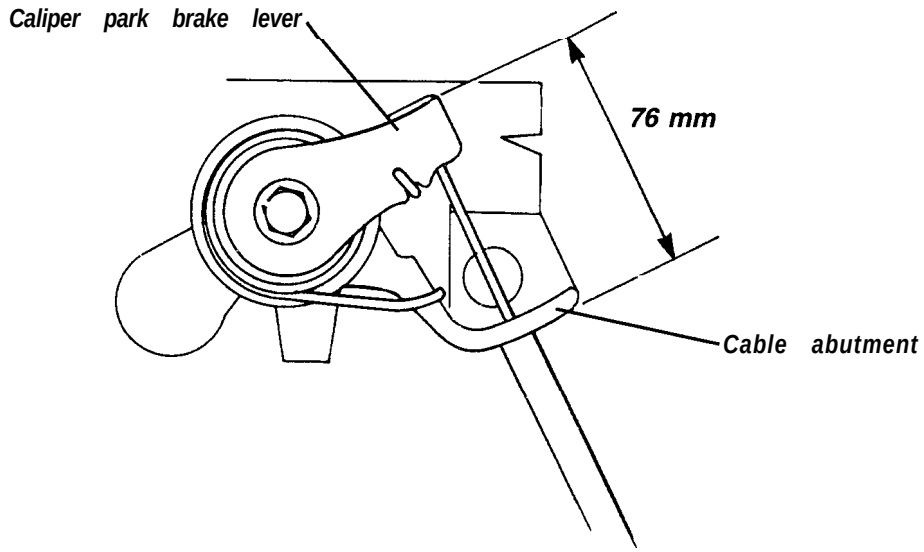
Parking Brake Mechanism • Brembo S4

The Brembo caliper uses two discs separated by hardened steel balls in ramps machined in the discs, to convert the rotation of the drive disc (to which the parking brake lever is attached) into axial movement of the driven disc, whose rotation is restrained by a stop bolt. The axial movement of the driven disc is transmitted to the caliper piston by a screwthread mechanism which compensates for pad wear by rotation of the nut within the piston when the footbrake is applied.



J126

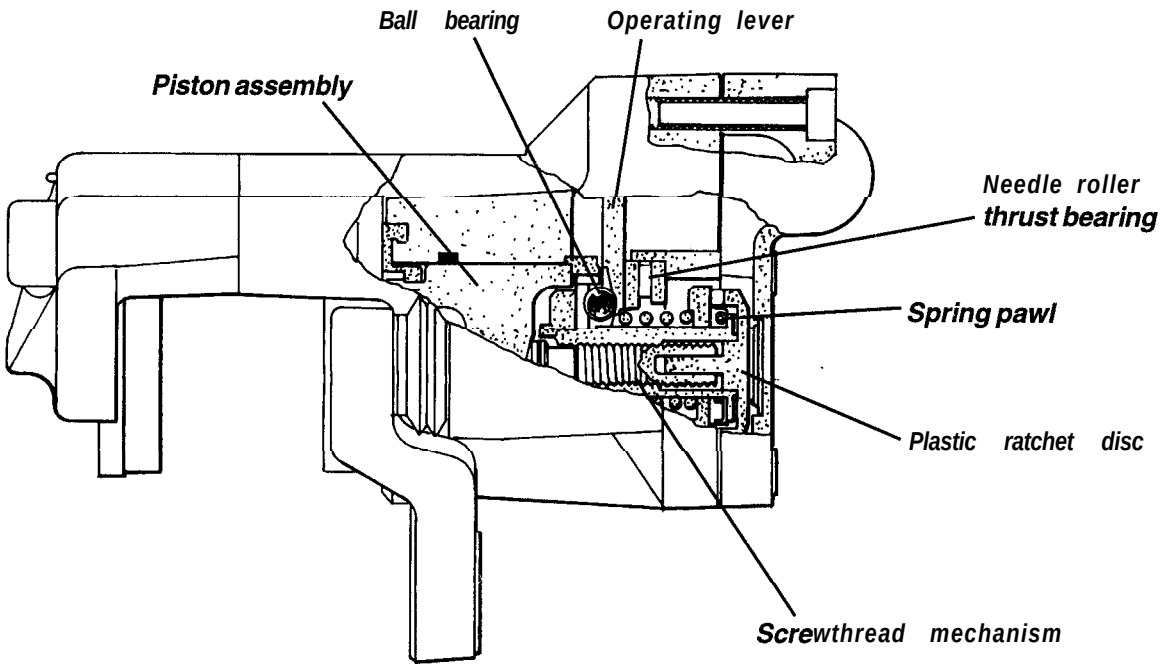
For the auto adjustment system to function correctly, it is essential that each caliper parking brake lever is allowed to return fully when the brake is released, and is not prevented from doing so by maladjustment of the parking brake cable. To check that the caliper levers are fully returned; with the parking brake 'off', measure the distance between the cable abutment and caliper lever as shown.



After verifying this dimension, any slack in the cables may be adjusted out at their forward abutment inside the driver's sill trim panel. For access to the cable adjusters, slide the driver's seat fully forward and lift the rear end of the sill carpet to expose the trim panel aperture. After adjustment, re-check the caliper lever 'off' dimension.

Parkina Brake Mechanism - A.P. Racing: Sport 300

On Sport 300 models, a dedicated parking brake caliper is mounted on the rear of each rear hub carrier. The single piston sliding calipers are operated by cable and incorporate a self adjustment mechanism to compensate for pad wear.



The lever to which the cable attaches is contained within the caliper body, protected by a bolt on cover, and uses a system of balls and ramps to convert the rotation of the lever into axial movement of the piston via an adjuster screwthread mechanism. The screwthread is linked to a plastic ratchet disc via a tongue and groove. A spring pawl rotates with the lever, and if the piston movement on application becomes excessive, the pawl rides over a ratchet tooth on the disc, which it subsequently causes to rotate when the brake is released and the mechanism is unloaded, when the lever and pawl return to their start positions. This rotation of the disc is transferred to the screwthread which extends the piston and takes up the free play which would otherwise develop.

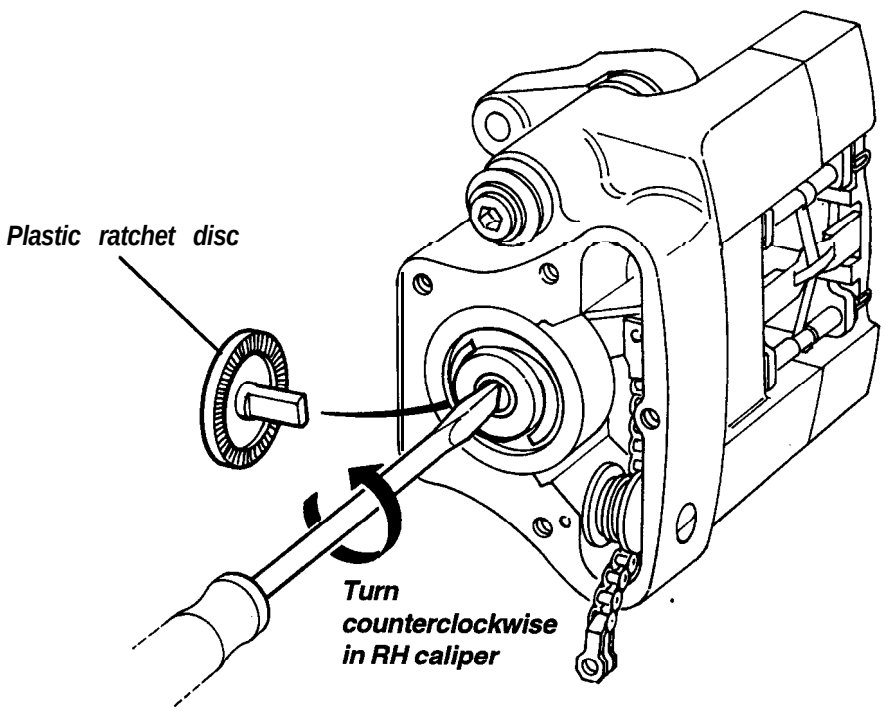
A short length of chain is used in conjunction with a pulley wheel to connect the operating cable to the caliper lever, and provides for an optimum cable run. The chain linkage is contained behind the caliper cover.

When adjusting the parking brake cables, care must be taken to take out only the slack, and not to preload the caliper mechanisms, whose levers are concealed by covers. For access to the cable adjusters, slide the driver's seat fully forward and lift the rear end of the sill carpet to expose the trim panel aperture.

To replace the parking brake pads:

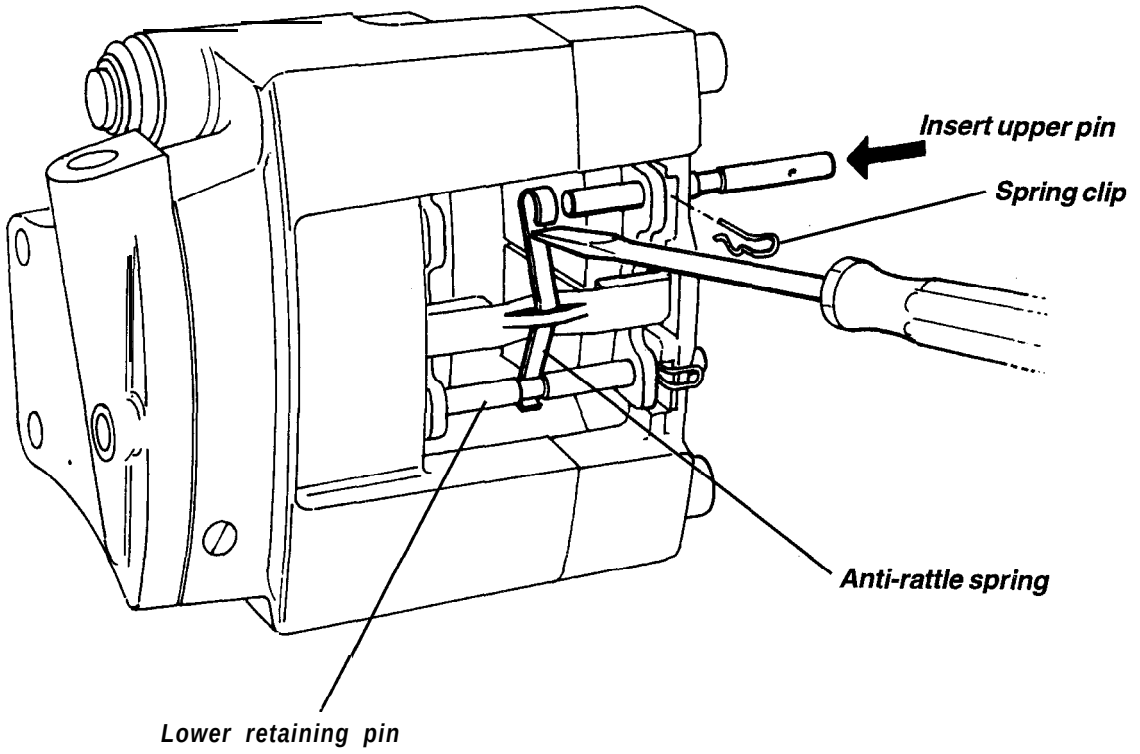
1. Pull out the spring clips and tap out the two pad retaining pins whilst pressing down the appropriate leg of the anti-rattle spring. Withdraw the anti-rattle spring and pads from the caliper.

2. Before fitting new pads, the piston must be retracted into the caliper;
   - In order to allow the caliper cover to be removed, it is necessary to either slacken or disconnect the parking brake cables from the cabin end. For access, slide the driver's seat fully forward and lift the carpet at the rear end of the sill trim panel.
   - Release the 5 capscrews, and pull away the caliper mechanism cover with the cable still attached.
     Pull out the white plastic ratchet disc and use a flat blade screwdriver to screw the screwthread mechanism into the piston and allow the piston to be retracted.
   - Turn the screwthread: · clockwise in the LH caliper;
     · counterclockwise in the RH caliper.
   - Refit the ratchet disc and caliper cover with gasket and ratchet disc spring.



J127

3. Fit the new pads into the caliper and retain with one of the two pins. Fit the anti-rattle spring into position with one leg engaged beneath the central, waisted part of the pin. Insert the second pin whilst holding down the other leg of the anti-rattle spring. Secure the two retaining pins with the spring clips.



4. Re-connect the front end of the cables and adjust carefully to take out any slack without preloading the caliper mechanism. Operate the brake several times to allow the caliper self adjusting mechanism to set the brake pad postion.

JF.8 - BRAKE BLEEDING PROCEDURE

If a Powermaster IIIA booster/master cylinder assembly, or a pump/accumulator assembly has been replaced, or if air has entered (or is suspected in) the brakelines, the entire brake system including all hydraulic units must be bled at each wheel. If only a hydraulic part of the booster/master cylinder or pump/ accumulator has been replaced, and air has not entered the brake lines. it may only be necessary to bleed at the booster/master cylinder bleed nipples.

Manual Bleeding

1. Ensure ignition is switched off.

2. De-pressurise the accumulator by FIRMLY applying and releasing the brake pedal up to 40 times. A noticeable change in brake pedal feel (to a hard pedal) will occur when the accumulator is completely discharged.

3. Clean the reservoir cover and top of the reservoir before squeezing the release tabs and lifting off the cover and diaphragm assembly.

4. Fill or top up both front and rear compartments using only DOT 4 brake fluid from a sealed container until levels reach the full marks.
IMPORTANT · Use only DOT 4 brake fluid. Do not use DOT 5 silicone fluid, or any fluid which has been exposed to the atmosphere for more than a brief period, or any fluid suspected of being wet, dirty or contaminated.
Refit the reservoir cover and diaphragm assembly.

5. If a replacement booster/master cylinder assembly has been fitted, or if there is difficulty when trying to bleed the front master cylinder sections,ensure all air is removed from the master cylinder body by opening the brake pipe tube nuts on the master cylinder (front two only) approximately two turns, or until fluid begins to bleed. Torque tighten the pipe nuts:
- Front pipe (LHF brake) M13: 24 · 26 Nm (18 · 19 lbf.ft)
- Second pipe (RHF brake) M12: 22 · 24 Nm (16 · 18 lbf.ft)

6. Bleed right front wheel brake:
- Attach bleeder hose to caliper nipple and submerge opposite end in clean brake fluid.
- Open bleed nipple.
- Slowly depress brake pedal.
- Close bleed nipple.
- Release brake pedal.
Check fluid level and top up as necessary.

7. Repeat step 6 until the brake pedal feels firm at half travel and no air bubbles are observed in the bleeder hose.

8. Repeat steps 6 and 7 on the left hand front brake.

9. Turn the ignition on and allow the pump to run and pressurise the accumulator. **NOTE:** Turn off the ignition if the pump runs for longer than 60 seconds, and refer to 'Pump Runs Continuously' (see later).

10. Bleed right hand rear caliper:
Attach bleeder hose to caliper nipple and submerge opposite end in clean brake fluid.
Open bleed nipple.
With ignition on, **lightly** depress the brake pedal until fluid begins to flow from the hose. The harder the pedal is pressed, the more fluid will flow. Do not fully depress the pedal. Note that the pump will run during this process. Allow fluid to flow for about 15 seconds.
Close bleed nipple, then release brake pedal.
- Repeat as necessary until no air bubbles are seen at the bleeder hose.

11. Check fluid level in the reservoir rear chamber. To avoid de-pressurising the accumulator at this interim stage, top up the reservoir rear chamber to a level 25 mm below the full mark.
IMPORTANT: Final fluid level must be checked after de-pressurising unit at step 14.

12. Repeat steps 10 and 11 for the left hand rear caliper.

13. Bleed master cylinder isolation valves:
Attach a bleeder hose to the bleed nipple on the inboard side of the master cylinder, and sub merge opposite end in clean brake fluid.
With ignition on, apply light force to the brake pedal and slowly open the bleeder valve to allow brake fluid to flow until no air is seen in the fluid.
Close the bleed nipple when fluid begins to flow without air bubbles.
Repeat procedure on the outboard side nipple.
(or use the 'Tech 1' bleeding sequence)

14. Bleed accumulator:
Turn off ignition, de-pressurise the accumulator by FIRMLY applying and releasing the brake

pedal up to 40 times. A noticeable change in brake pedal feel (to a hard pedal) will occur when the accumulator is completely discharged.

Wait two minutes for air to clear from-the brake fluid in the reservoir.

- Remove the reservoir cover and check the level in both front and rear sections of the reservoir. If necessary, top up to the correct level - see start of this section. Refit reservoir cover.
- Turn on the ignition and allow the pump motor to run.

NOTE: Turn off the ignition if the pump motor runs for more than 60 seconds. Refer to 'Pump Motor Runs Continuously' in this section.

15. Bleed booster section of the booster/master cylinder assembly:

Depress the brake pedal with moderate pressure and turn on the ignition without starting the engine for 3 seconds.

Repeat this off/on procedure 10 times to cycle the solenoids.

(part of 'Tech 1' bleed sequence)

16. Assess brake pedal 'feel':

Apply brake pedal and note pedal feel and travel.

If pedal feels firm and smooth without excessive travel, system is properly bled.

If pedal feels soft or spongey or travel is excessive, refer to 'Excessive Pedal Travel' in this section.

If a 'bump' is noted upon initial pedal application, or application does not feel smooth and uniform, refer to 'Non-Uniform Pedal Feel' in this section.

17. Road test vehicle and note pedal travel and feel. If any symptoms described above in step 16 appear, refer to the appropriate section below.

Excessive Pedal Travel

Excessive brake pedal travel exists if, when driving the vehicle, braking action does not start until after the first 35 mm (1.4 in) of pedal travel. If after carrying out the brake bleeding procedure above, excessive travel is evident, proceed as follows:

1. Re-bleed front brakes (rear brake circuit may be omitted) as described above in steps 6, 7 & 8 of 'Manual Bleeding', and check brake fluid levels.

2. Re-assess pedal feel as in step 16 of 'Manual Bleeding' above. If excessive travel is still evident, first check fluid level, then check for leakage throughout the brake system.

Non-Uniform Pedal Feel

Bleed the system using the 'Tech 1' bleeding procedure.

Pump Runs Continuously

IMPORTANT: This procedure is to be used if the pump runs for more than 60 seconds.

1. With the ignition off, de-pressurise the accumulator by FIRMLY applying and releasing the brake pedal up to 40 times. A noticeable change in brake pedal feel (to a hard pedal) will occur when the accumulator is completely discharged.

   NOTE: In the following steps, use a suitable container and/or shop towels to catch the brake fluid and prevent it from contacting any painted surfaces.

2. Loosen but do not remove the two tube nuts from the master cylinder front chamber (for the left and right hand front brakes).

3. Press the pedal to its fullest extent. Fluid should run slowly from around the tube nuts.

4. With the pedal depressed, tighten both the tube nuts.

5. Quickly release the pedal and re-apply using a jabbing (sharp and rapid) motion with full force.

6. Turn on the ignition and allow the motor to pressurise the accumulator.

7. Assess brake pedal feel, and road test-as in steps 16 & 17 of 'Manual Bleeding'.
IMPORTANT: If the pump still runs continuously, refer to 'Hydraulic Diagnosis'

JF.9 · FRONT CALIPER OVERHAUL

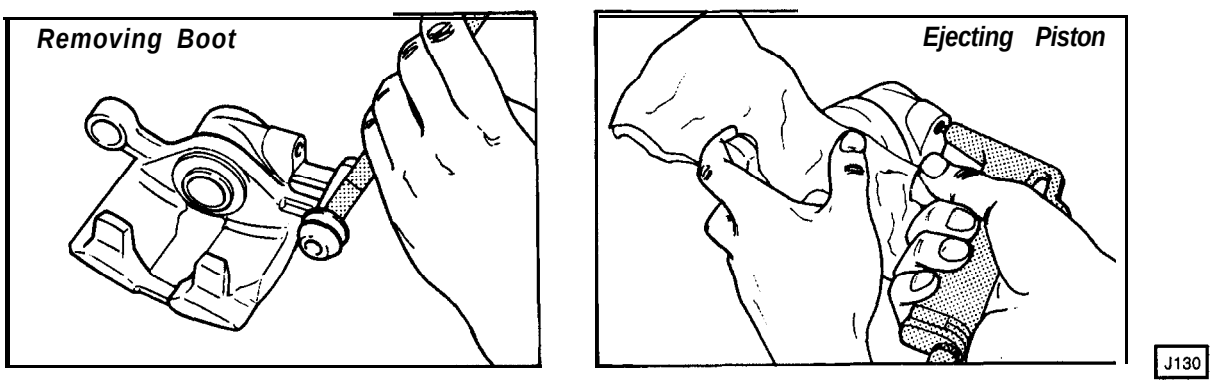
The dust boots and hydraulic seals of the TMC calipers may be replaced, but if there is any visible marking or wear on the pistons or cylinder bores, the complete caliper assembly should be replaced. The sliding pins of the TMC caliper may also be overhauled. The AP Racing calipers fitted to the Sport 300 however, are to be overhauled only by AP Racing at Wheeler Road, Seven Stars Industrial Estate, Coventry, CV3 4LB. No attempt should be made to dismantle or repair the Brembo calipers.

Front Calioer Overhaul · TMC (Prior June/July '94)

1. Disconnect the brake hose from the caliper brake pipe and bracket. Remove the caliper swing release bolt, raise the caliper and draw off from the top slide pin.

2. Remove the lower sliding bush and its rubber boots.

3. Remove the top pin boot from the caliper using a small chisel as shown.

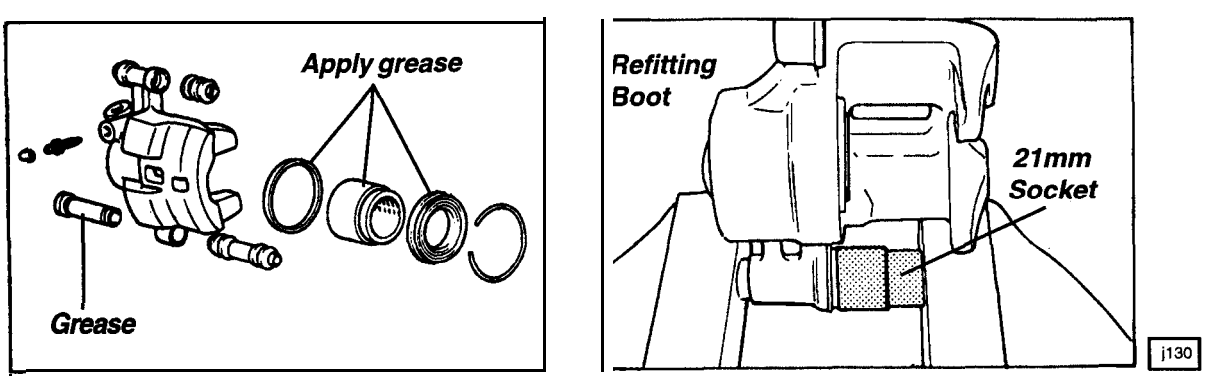


4. Remove the spring ring and boot from the piston bore and use compressed air to eject the piston from the cylinder.
WARNING: Keep fingers well clear during this operation, and use rags to guard against brake fluid spray.

5. Remove piston seal from cylinder.

6. On re-assembly, apply rubber grease to parts as indicated.

7. Instal piston seal into cylinder bore, and insert piston. Fit cylinder dust boot, and retain with spring ring.



a. Fit the top slide pin boot by using a 21 mm socket as shown.

9. Fit the sliding bush with its two boots.

10. Instal the caliper onto the top slide pin, swing down, and refit the lower sliding pin bolt. Torque tighten to 16 · 14 Nm (12 · 17 Ibf.ft).

11. Reconnect the brake hose, and bleed the brakes.

JF.10 · REAR CALIPER OVERHAUL

The Bendix rear calipers may be overhauled and new seals and dust boots fitted. If the parking brake mechanism within the piston needs attention, the complete cylinder assembly should be replaced. For the Brembo footbrake and Sport 300 parking caliper, only the sliding pins may be overhauled, with any signs of hydraulic leakage from the footbrake caliper being rectified by the fitting of a new caliper. The Sport 300 rear footbrake uses AP Racing calipers which should be overhauled only by AP Racing at Wheeler Road, Seven Stars Industrial Estate, Coventry, CV3 4LB.

Rear Caliper Overhaul · Bendix (Prior June/July '94)

1. Disconnect the handbrake cable and brake hose from the caliper.

2. Remove the locking clips, slide out the caliper retaining plates (see JD.3), and remove caliper to bench.

3. Clean the caliper thoroughly. Remove piston boot. Using a l/4" drive ratchet, unscrew the piston from the handbrake adjustment mechanism.

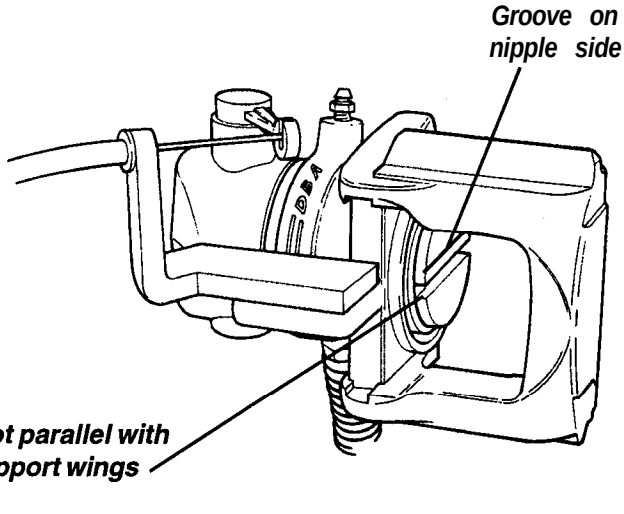
4. Using a rag to protect against brake fluid spray, and keeping fingers well clear, use compressed air to eject the piston from the cylinder. Remove seal from groove in cylinder.

5. Clean the groove, cylinder bore and piston with methylated spirit and dry with compressed air. Inspect the groove, bore and piston surface for any signs of scratching or pitting. If any such signs are apparent, a replacement cylinder assembly should be fitted.

6. Fit a new seal into the cylinder groove. Lubricate the piston and bore with brake fluid and press the piston into the cylinder.

7. Smear the exposed part of the piston with the special Lockheed grease supplied in the seal kit, and fit a new dust boot.

a. Screw the piston fully in along the handbrake adjuster mechanism, and then position with the piston slot parallel with the two support wings and the groove toward the bleed nipple side. (See pad replacement procedure JF.6).

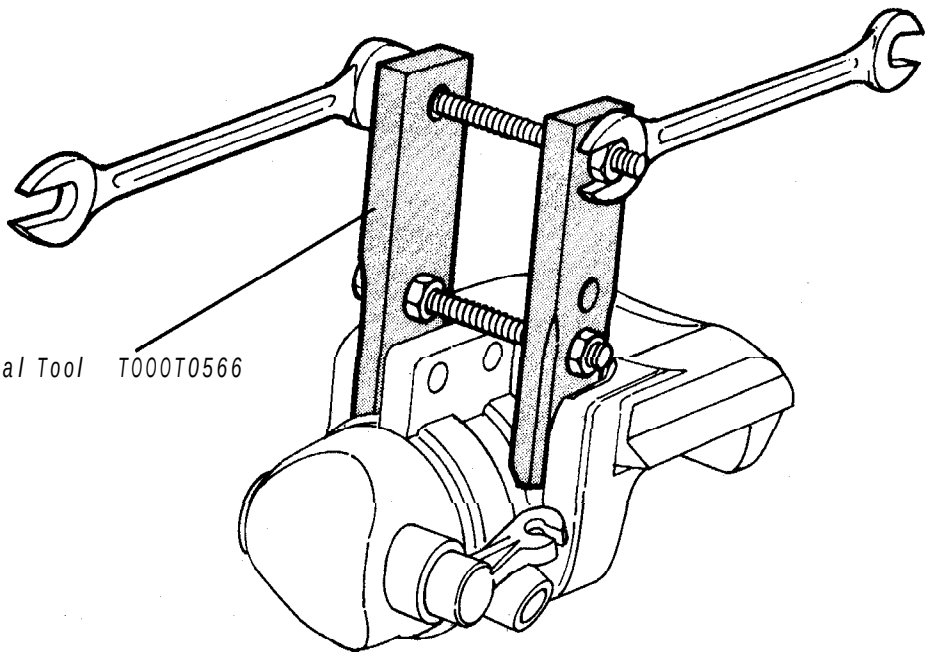


Bendix Cylinder Removal

If it is necessary to replace a cylinder assembly, special spreader tool TOOOT0556 must be used to avoid damaging the special protective coating-on the cylinder and wings of the carrier bracket:

4 Position the tool as shown and adjust the inner nuts on the lower stud to set the ends of the tool snugly against the wings of the carrier bracket.

b) Gradually tighten the two nuts on the upper stud until the cylinder is no longer gripped by the carrier bracket. It may be necessary to re-position the tool to enable the cylinder to move easily.



c) Using a 3 mm allen key or similar, depress the spring loaded pawl and slide the cylinder out of the carrier.

Bendix Cylinder Replacement

d) With the tool holding the wings of the carrier apart, slide the new cylinder into the carrier bracket whilst depressing the locking pawl.
NOTE: Check that the cylinder is fitted the correct way up.

e) Ensure that the pawl locks into the carrier bracket locating hole and remove the spreader tool.

Rear Caliper Slidina Pins · Brembo (June/July '94 onwards)

The sliding bushes and sleeves of the Brembo rear calipers may be replaced without disturbing the hydraulic connection:

a) Disconnect the parking brake cable from the caliper.

b) Remove the cap head bolt securing the bottom guide bush to the caliper adaptor plate.

c) Remove the hex. head bolt securing the top guide bush to the caliper adaptor plate, and withdraw the caliper from the car with the brake hose still connected.

d) Slide out the lower steel guide sleeve and withdraw the bush/boot from the caliper. Pull the boots off the top steel guide bush and slide out the bush from the caliper.

e) Clean the guide bores in the caliper body with brake cleaner. Lubricate the new bushes and boots with silicone grease provided in the repair kit, and reassemble into the caliper in reverse order to

disassembly.

f) Refit the caliper to the adaptor plate, torque. tightening the two fixings to:
Upper M10 bolt; 45 - 50 Nm (33 - 37 lbf.ft)
Lower M8 caphead; 26 - 30 Nm (19 - 22 lbf.ft)

g) Reconnect the parking brake cable and operate the brakes several times before driving the car

Parkina Caliper Slidina Pins - Sport 300 (Brembo)

a) Remove the socket head guide bolt from the lower end of the caliper, and the caphead bolt securing the top guide bush to the caliper plate.

b) Withdraw the caliper from the brake disc, and slide out the lower guide bolt, and the upper guide bush. Remove from the lower caliper bore, the Teflon and rubber bushes. From the caliper top guide pin bore, remove the two rubber boots.

c) Clean the caliper bores and all other parts to be reused, and re-assemble in reverse order to dissassembly using silicone grease on the sliding components.

JF.11 - BRAKE DISCS

The condition of the brake disc friction surface is a major factor in brake performance and feel, with a good surface quality and minimal run-out and thickness variation being required. After an extended lay up, some surface rust may develop on the discs which will cause a degradation in braking quality until the surfaces are cleaned up by normal brake action. Excessive run-out or thickness variation as a result of overheating or extended wear, may cause brake judder and/or extended pedal travel due to pad 'knock off'. It may be possible to rectify excessive surface rusting/pitting or warping by resurfacing both sides of the disc using specialist equipment, but on no account should the minimum thickness be transgressed. NOTE: Ensure the front wheel bearings are correctly adjusted before measuring front disc run-out.

Brake disc thickness

		TMC/Bendix	*Brembo*	*A. P. Racing*
Front	- nominal	**20** mm (0.79 in)	**28** mm (1.10 in)	**28** mm (1.10 in)
	- minimum	19 mm (0.75 in)	**25** mm (0.98 in)	26.9 mm (1.06 in)
Rear	- nominal	12 mm (0.47 in)	**22** mm (0.87 in)	28 mm (1.10 in)
	- minimum	11 mm (0.43 in)	20.4 mm (0.80 inj	26.9 mm (1.06 in)

Maximum disc runout

Front	0.15 mm (0.006 in)	0.10 mm (0.004 in)	0.10 mm (0.004 in)
Rear	**0.20** mm (0.008 in)	0.15 mm (0.006 in)	0.15 mm (0.006 in)

Maximum Thickness Variation

Front and rear	0.015 mm (0.0006 in)	0.015 mm (0.0006 in)	0.015 mm (0.0006 in)

Front Disc Replacement

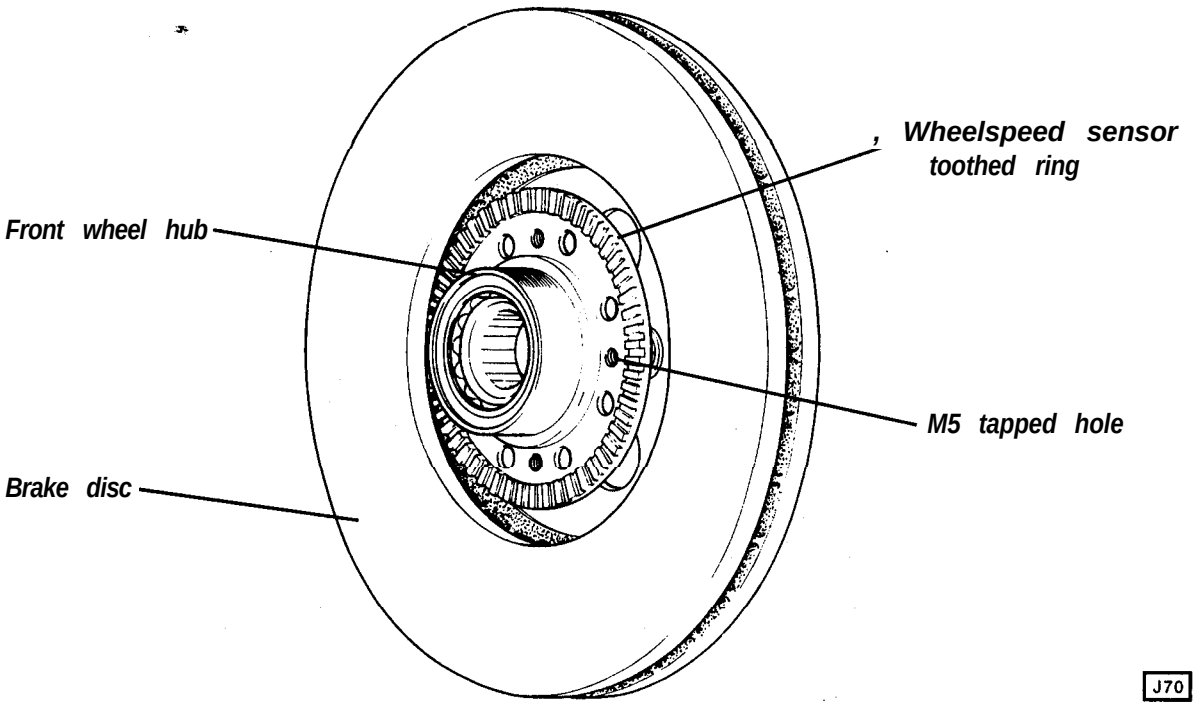
Before fitting a new brake disc, ensure that any corrosion protective coating is removed from the braking surface of the disc with a suitable solvent. Otherwise contamination of the brake pads may occur resulting-in initial poor brake performance.

TMC brakes

On cars with TMC front brakes, the brake discs are fixed to the inboard sides of the front hubs, which must be removed from the car to before the discs may be replaced.
To remove a front disc:

- Remove the hub/disc assembly as detailed in sub-section CD.5 ('91 & '92 M.Y.) or CF.4 ('93 M.Y. onwards).

To obtain access to the disc/hub bolts, the speed sensor toothed ring must first be withdrawn from the hub. Use four M5 screws through the tapped holes in the sensor ring either to push the ring from the hub, or to attach a suitable puller, taking care not to twist or distort the ring.



Remove the four MI0 bolts, and withdraw the disc from the hub.

When re-assembling, ensure scrupulous cleanliness of the disc to hub jointface. Torque tighten the four disc retaining bolts to 52 · 55 Nm (38 · 40 lbf.ft) before pressing the sensor ring onto the hub up to the shoulder. Adjust the hub bearings as detailed in sub-section CD.5 ('91 & '92 M.Y.) or CF.4 ('93 M.Y. onwards).

Brembo brakes

The Brembo front brake discs are fitted on the outboard side of the front hubs, and are retained for convenience when the front wheels are removed, by a single socket head recessed screw. To, remove a brake disc, release the front caliper fixing bolts and withdraw the caliper from the disc. Remove the retaining screw, and withdraw the brake disc.

When re-fitting, ensure scrupulous cleanliness of the disc to hub jointface before mounting the disc and retaining with the recessed screw. Refit the brake caliper.

A.P. Racing brakes

Sport 300 models use alloy mounting bells to connect the brake discs to the inboard side of the front hubs. A ring of 12 socket head bolts secures each front disc to the mounting bell.

To remove a front disc:

Remove the hub/disc assembly as detailed in sub-section CD.5 ('91 & '92 M.Y.) or CF.4 ('93 M.Y. onwards).

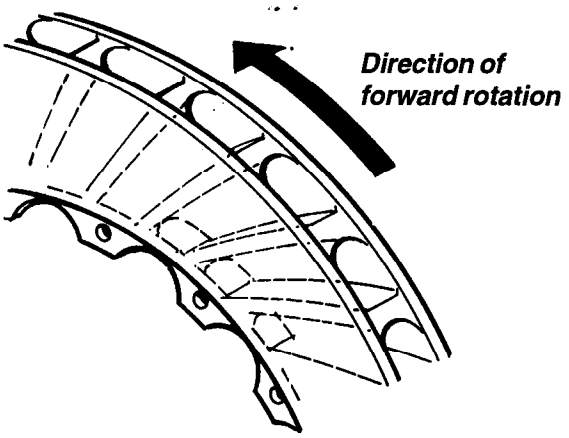
Remove the 12 socket head bolts securing the disc to the mounting bell, and withdraw the disc.

If the mounting bell is to be removed from the hub, the speed sensor toothed ring must first be withdrawn before access to the four fixing bolts is available. Use four M5 screws through the tapped holes in the sensor ring either to push the ring from the hub, or to attach a suitable puller, taking care not to twist or distort the ring. Note that a steal bobbin is pressed into each of the four fixing holes in the mounting bell.

Re-fitting a front disc:

Note that the brake discs are handed due to the curved cooling vanes. Air is drawn into the inside

of the disc and centrifuged from the outside edge. The curvature of the vanes trails the direction of forward rotation (see diagram).



1424

Before fitting the alloy mounting bells to the hubs, check that a steel load spreading bobbin is pressed into each of the mounting holes. Apply Permabond Al 15 to the threads of the four mounting bell retaining bolts before tightening to 47 Nm (35 Ibf.ft).

Press the wheel speed sensor ring onto the hub up to the shoulder.

Ensure scrupulous cleanliness of the disc to mounting bell jointface before fitting the 12 retaining bolts and tightening to 16 Nm (12 Ibf.ft).

Adjust the hub bearings as detailed in sub-section CD.5 ('91 & '92 M.Y.) or CF.4 ('93 M.Y. onwards).

Rear Disc Replacement

Bendix & Brembo brakes

The rear discs are mounted between the outboard side of the rear hubs and the roadwheels, and are retained for convenience when the roadwheels are removed, by a pair of countersunk 'Torx' headed screws. On Bendix brake cars, the caliper must be released before the brake disc may be withdrawn, 'but on Brembo cars removal of the rear brake pads allows sufficient clearance for the disc to be removed.

When refitting, ensure scrupulous cleanliness of the disc to hub jointface before mounting the discs and retaining with the two countersunk screws.

A.P. Racing brakes

Sport 300 models use alloy mounting bells to connect the rear brake discs to the hubs, with a ring of eight socket head bolts securing each disc to the mounting bell. The bells are retained to the hub for convenience when the roadwheels are removed, by a pair of countersunk 'Torx' headed screws. To remove a brake disc, the caliper must first be released to allow the disc and mounting bell assembly to be withdrawn from the hub.

When refitting, note that the brake discs are handed due to the curved cooling vanes. Air is drawn into the inside of the disc and centrifuged from the outside edge. The curvature of the vanes trails the direction of forward rotation (see diagram above). Tighten the disc to mounting bell bolts to 16 Nm (12 Ibf.ft).

JF.12 · RETRO-FITMENT OF BREMBO BRAKES TO ESPRIT S4

Brembo brake calipers and discs were introduced on Esprit S4 models at the following change point:

Non-USA cars: running change during '94 M.Y. at VIN R 1443 (+ 1377). August '94
USA cars: at intro. of '95 M.Y. at VIN S 1391. June '94.

The Brembo brake system, compared with the earlier TMC/Bendix system, provides increased braking efficiency and tolerance to heat build up caused by frequent hard use, as may occur during track sessions or exceptionally severe road driving. The effective radius of the wheel brakes is increased at

both front and rear, and the capacity for heat dissipation is considerably enhanced by thicker ventilated front discs, and a change from solid to ventilated rear discs. Fitment of the Brembo brake system to earlier Esprit S4 models is permissible only-as a complete car set using kit 'LOTSKESOOI' as detailed below.

The Brembo brakes differ from the earlier type TMC/Bendix brakes in the following respects:

	TMC/Bendix	Brembo
Front Calipers	Single piston sliding calipers	Four piston fixed calipers
Front Discs	Ventilated 258 x 20	Ventilated 296 x 28
Rear Calipers	Single piston sliding calipers	Single piston sliding calipers
Rear Discs	Solid 275 x 12	Ventilated 300 x 22

- The anti-lock system is unchanged.
  The parking brake (as previously) uses cable operation of the rear caliper pistons, and adjusts automatically to compensate for pad wear.
- A new 16" spare wheel is required in order to clear the greater diameter of the brake system components.
- The wheels fitted to pre-S4 cars will not accommodate Brembo brakes.
- At the front, the new brake discs are mounted on the outboard side of the new hubs (previously mounted on inboard side of the hubs). Adaptor brackets are used to mount the new calipers to the existing hub carriers.
  At the rear, adaptor plates are used to mount the new calipers to the hub carriers. New hub carriers use a reprofiled lower stiffening web in order to accommodate the hole required to route the parking brake cable, without loss of strength.
  The rear brake circuit limiting/proportioning valve (fitted to prevent over adjustment of the parking brake mechanism) is deleted and replaced by a 3-way connector.

Parts Reauired

Description	Part Number	Qty	
Brembo Brake Kit	LOTSKESOOI	1	
comprising:			
Brake Caliper Assembly, front, LH	A082J4383F	1	) inc. pads
" " " " RH	A082J4382F	1	)
Capscrew, M12x65, caliper to adaptor bracket	Al OOW7083F	4	
Flat Washer, " " "	A082J4386F	4	
Adaptor Bracket, front caliper to hub carrier	A082J4376K	2	
Setscrew, Ml2x35, adaptor brkt. " "	A075W1059Z	4	
Spring Washer, M12, " " " "	A075W4069F	4	
Brake Disc, front	A082J4380F	2	
Screw, M10, brake disc retention	A082J4381 F	2	
Brake Caliper Assembly, rear, LH	A082J6151 F	1	) inc. pads
" " " " RH	A082J615OF	1	)
Setscrew, M10x80, caliper to mounting bracket	A082W1113F	2	
Capscrew, M8x60, " " " "	A082W1114F	2	
Adaptor Plate, caliper to hub carrier, LH	A082 J4375F	1	
" " " " " " RH	A082J4374F	1	
Brake Disc, rear	A082D416OF	2	
Brake Pipe, front hose to caliper	A082J4387F	2	
3-Way Connector, rear brake circuit	BO75J6019F	1	
Bolt, M8x35, 3-way to chassis	A075W2038D	1	
Flat Washer, " " "	A075W4020Z	2	
Nyloc Nut, M8, " " "	A075W301 OZ	1	

Continued . . . . . .

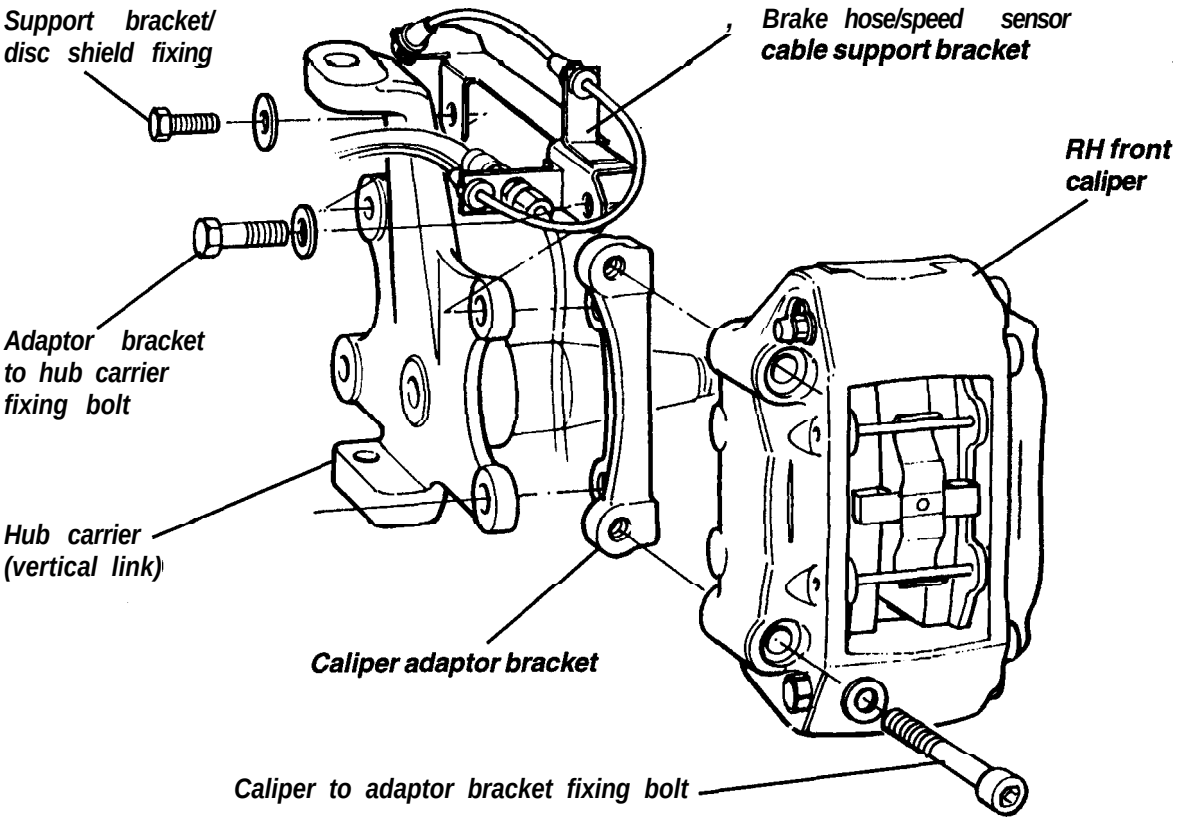
Parts Reauired (Continued)

Description	Part Number	Qty
Brake Pipe, RHR rad. arm hose to 3-ways	P691.3301.008AF	1
Brake Hose, radius arm to caliper	A082J4390F	2
Cable, parking brake, short, driver's side	AO82J4373F	1
" " " long, passenger's side	A082J4372F	1
Grommet, park cable thro' chassis	A082L6181 F	2
Plate, grommet retention in body	A082J4392F	1
Screw, no.6 x 3/4", grommet plate to body	A075W5037Z	2
Spring Clip, park cable to radius arm	A089W6272F	4
Tie Wrap, park cable to radius arm	A082W6286F	1
Front Hub	A082C4239K	2
Bearing, front hub outer	A089C8005F	2
" " " inner	A089C8004F	2
Grease Seal, front hub	A089C8003F	2
Bracket, ABS cable support to hub carrier, LH	A082J4379F	1
" " " " " " " RH	A082J4378F	1
Hub Carrier, rear, LH	C082D4141 K	1
" " " RH	C082D4142K	1
Spare Wheel & Tyre Assembly	A082G6087F	1
'T'- Bolt, spare wheel retention	E082U4763F	1

Fittina Procedure

1. At each'front corner; clamp off the front brake hose, remove the front caliper, disc, hub, brake hose bracket and sensor cable support bracket. Use four M5 setscrews to press the speed sensor ring off the front hub taking care to apply pressure evenly to avoid distortion.

2. Fit the speed sensor ring onto the new front hub with the teeth facing inboard. Fit the new taper roller bearings and grease seal into the hub, and adjust the bearing preload as detailed in Service Notes sub-section CDS.


Support bracket/ disc shield fixing
Brake hose/speed sensor cable support bracket
RH front caliper
Adaptor bracket to hub carrier fixing bolt
Hub carrier (vertical link)
Caliper adaptor bracket
Caliper to adaptor bracket fixing bolt

j132

3. Fit the front caliper adaptor bracket (unhanded and symmetrical) to the outboard side of the hub carrier bosses, with the caliper flange turned inboard. At the same, time fit the new combined brake hose/speed sensor cable support bracket.
Torque tighten the caliper bracket to hub carrier fixing bolts (Ml2 x 35) to 65 Nm.

4. Fit the new brake disc and retain to the hub with the recessed screw, tightening to 12 Nm.

5. Fit the new caliper to the adaptor bracket with the bleed nipple uppermost. Tighten the Ml2 x 65 mounting bolts to 65 Nm. Secure the brake hose into the new support bracket, and fit the new brake pipe between hose and caliper. Tighten the pipe into the caliper using a split ring spanner and torque to 17 - 20 Nm.

6. Fit the speed sensor cable into the new support bracket lugs.

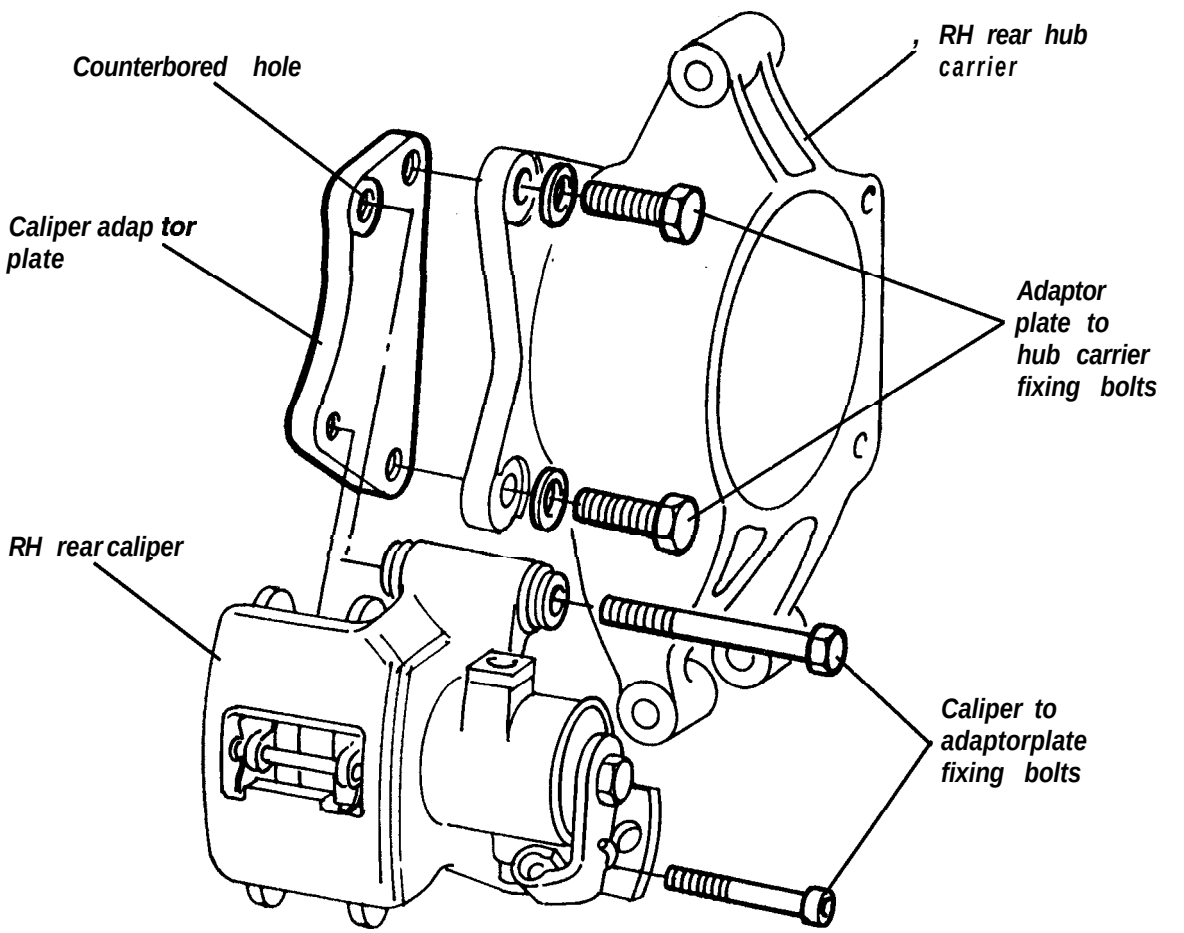
7. Repeat operations 1 to 6 for the opposite front corner.

8. At each rear corner; remove the rear disc. hub/wheel bearing assembly (retain), hub carrier and caliper brake hose.

9. Fit the existing hub/wheel bearing assembly to the new hub carrier, and reassemble the suspension as detailed in Service Notes section DC.

10. Fit the new rear brake disc and retain to the hub with the recessed screw, tightening to 12 Nm.

11. Fit the caliper adaptor plate to the hub carrier with the counterbored hole at the inboard top. Torque tighten the fixing bolts to 65 Nm.


Counterbored hole
RH rear hub carrier
Caliper adap tor plate
Adaptor plate to hub carrier fixing bolts
RH rear caliper
Caliper to adaptorplate fixing bolts

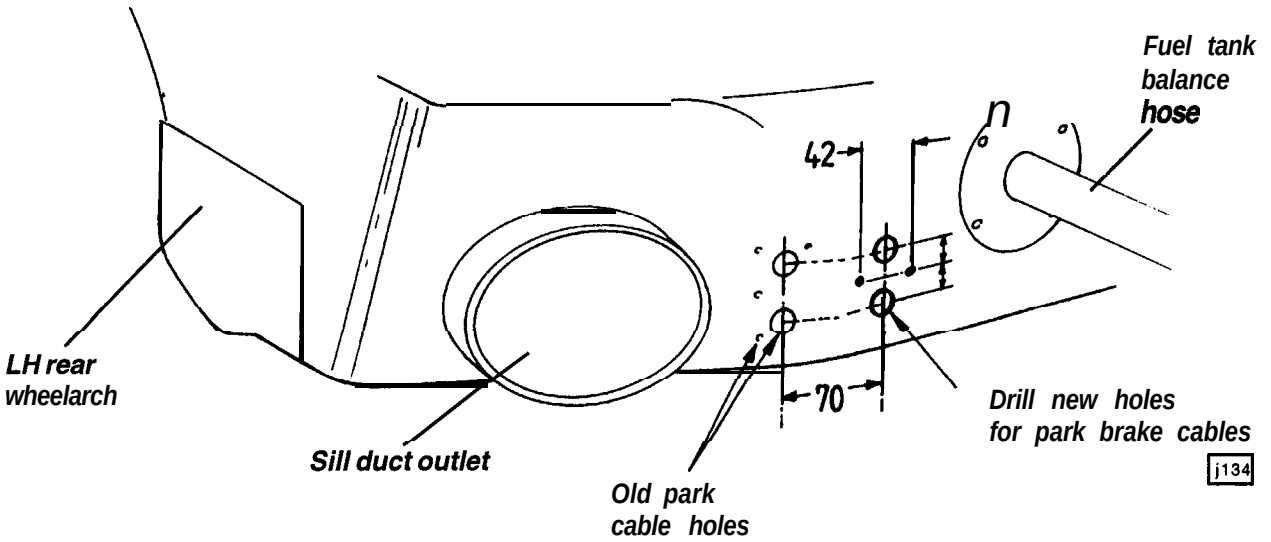
12. Fit the new caliper to the mounting plate with the parking brake lever lowermost. Torque tighten as follows:
Ml0 x 80 bolts: 45 · 50 Nm
M8 x 60 bolts: 26 · 30 Nm
Transfer the bleed nipple to the top port.

13. Fit the new brake hose into the caliper lower port and torque to 9 · 13 Nm. Connect the hose to the radius arm bracket and pipe.

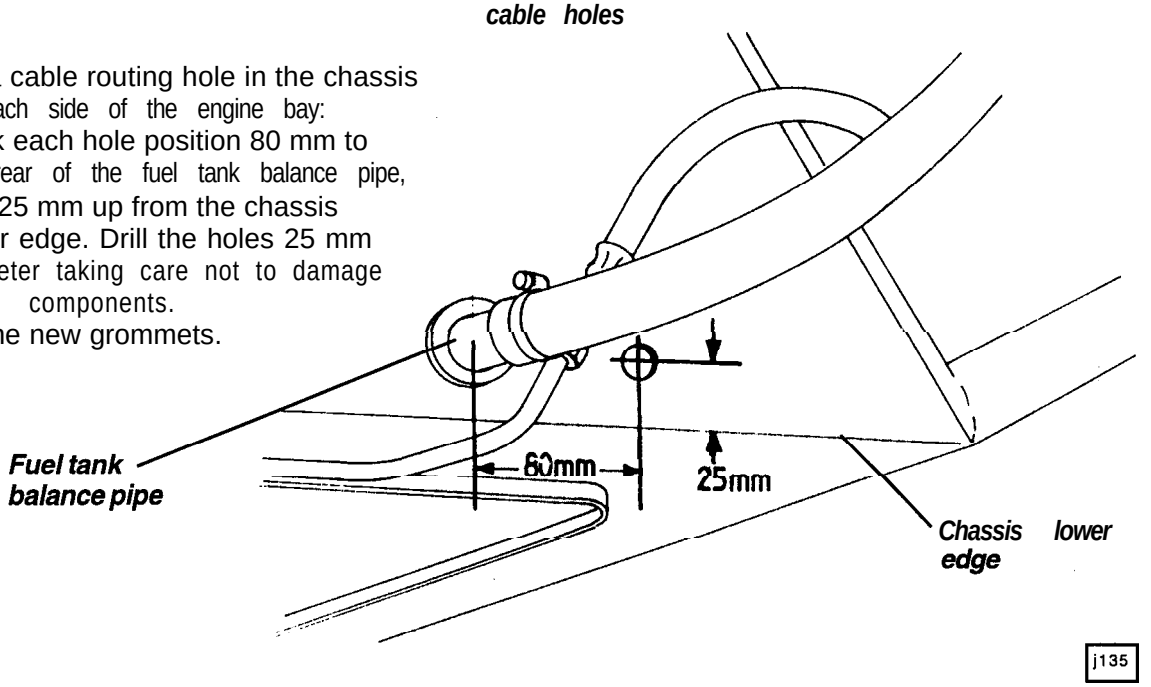
14. Repeat operations 8 to 13 for the opposite rear corner. Check rear wheel alignment, and adjust if necessary.

15. Remove the engine bay undertray, peel back the rear end of the sill carpet and remove the parking brake cables.

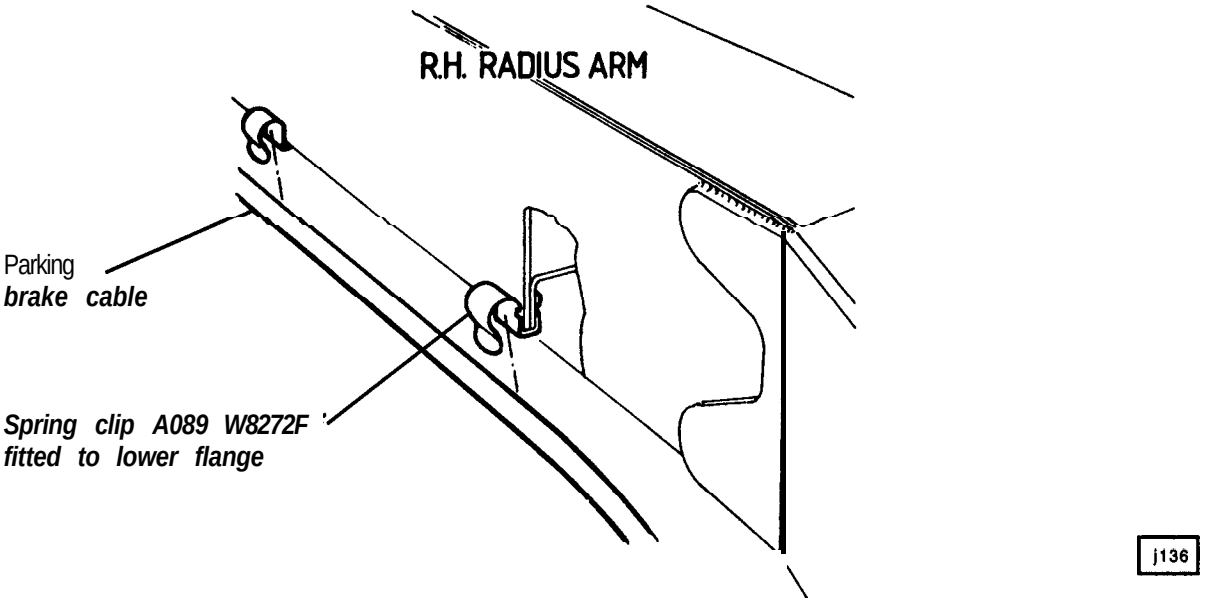
16. Reposition the holes in the fuel tank well for the park cables:
Mark the new hole positions 70 mm forwards of the existing holes, at the same height, and drill/ fettle to 25 mm diameter, taking care not to damage other components. Transfer the existing grommets to the new grommet plate, drill two 3.5 mm fixing holes in the body, and secure the plate with the two self tapping screws.



17. Drill a cable routing hole in the chassis at each side of the engine bay:
Mark each hole position 80 mm to the rear of the fuel tank balance pipe, and 25 mm up from the chassis lower edge. Drill the holes 25 mm diameter taking care not to damage other components.
Fit the new grommets.



18. Fit the new parking brake cables with the longest cable to the passenger side, routed through the lower hole in the fuel tank well, and the two new chassis grommets. Feed each cable through the hole in the hub carrier web before connecting to the caliper lever.
Secure each cable to the inboard lower flange of the radius arm using the new spring clips, and position to maintain cable clearance in the hub carrier. Use the tie wrap to secure the passenger side cable to the fuel tank balance pipe.



19. Adjust the cables as necessary, ensuring that the caliper levers are allowed to return fully.

20. At the outside of the right hand front corner of the engine bay, disconnect and remove the rear brake circuit pressure proportioning valve and cap the input pipe. Remove the pipe from the valve to the RH rear radius arm hose, and replace with the new brake pipe. Temporarily fit the three pipes into the new 3-way connector, and mark the fixing hole position on the chassis. Remove the connector and cap the pipes before drilling an M8 clearance hole for the connector fixing bolt.
Secure the 3-way connector using the M8x35 fixing bolt and washers, and fit and tighten the three brake pipes.

21 Bleed the brake system as detailed in Service Notes sub-section JF.8.

22. Substitute the new 16" spare wheel/tyre assembly and secure with the new 'T'- bolt.

Maximum braking efficiency will be achieved if, for the first few hundred miles, needless heavy braking is avoided, and the brake pads are allowed to 'bed-in' fully before being used to their full potential.

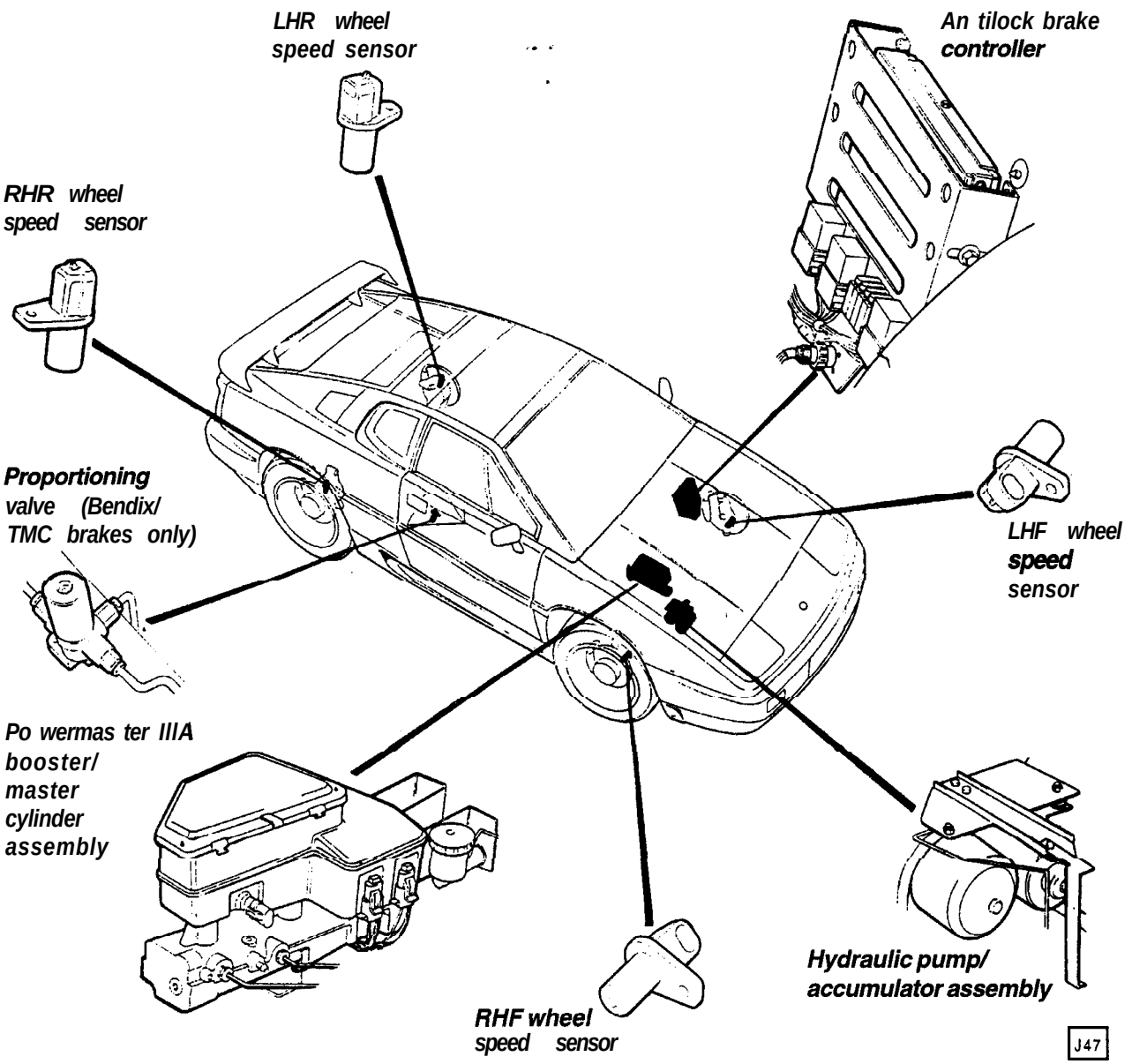
JF.13 - ABS SYSTEM THEORY OF OPERATION

The Delco Moraine Antilock Brake System (DM ABS-IIIA) consists of the following major components:

Powermaster IIIA Booster/Master Cylinder: Fitted on the front bulkhead in place of the conventional master cylinder and servo. Incorporates the front brakes master cylinder, power boost chamber, boost/ rear brakes spool valve, fluid reservoir, solenoid valves (3 off), displacement chambers (2 off), and isolator valves (2 off).

Hydraulic Pump/Accumulator Assembly: Fitted in the front luggage compartment. Provides hydraulic pressure for; front brake power assist, rear brake operation, ABS operation.

Antilock Brake Controller: Microprocessor fitted in the front luggage compartment. Processes signals received from the four wheel speed sensors and modulates brake line pressure via three solenoid valves in the Powermaster IIIA. Also monitors the system for faults, provides diagnostic information, and operates the ABS tell tale lamp.


LHR wheel speed sensor
An tilock brake controller
RHR wheel speed sensor
Proportioning valve (Bendix/ TMC brakes only)
LHF wheel speed sensor
Po wermas ter IIIA booster/ master cylinder assembly
Hydraulic pump/ accumulator assembly
RHF wheel speed sensor
J47

Wheel Speed Sensors: One variable reluctance sensor fitted at each wheel hub. Sends wheel speed signals to the ABS controller.

Solenoid Valves: Incorporated in the Powermaster IIIA. One for each front brake circuit, and one for the combined rear circuit. Modulate brake line pressure as commanded by the ABS controller.

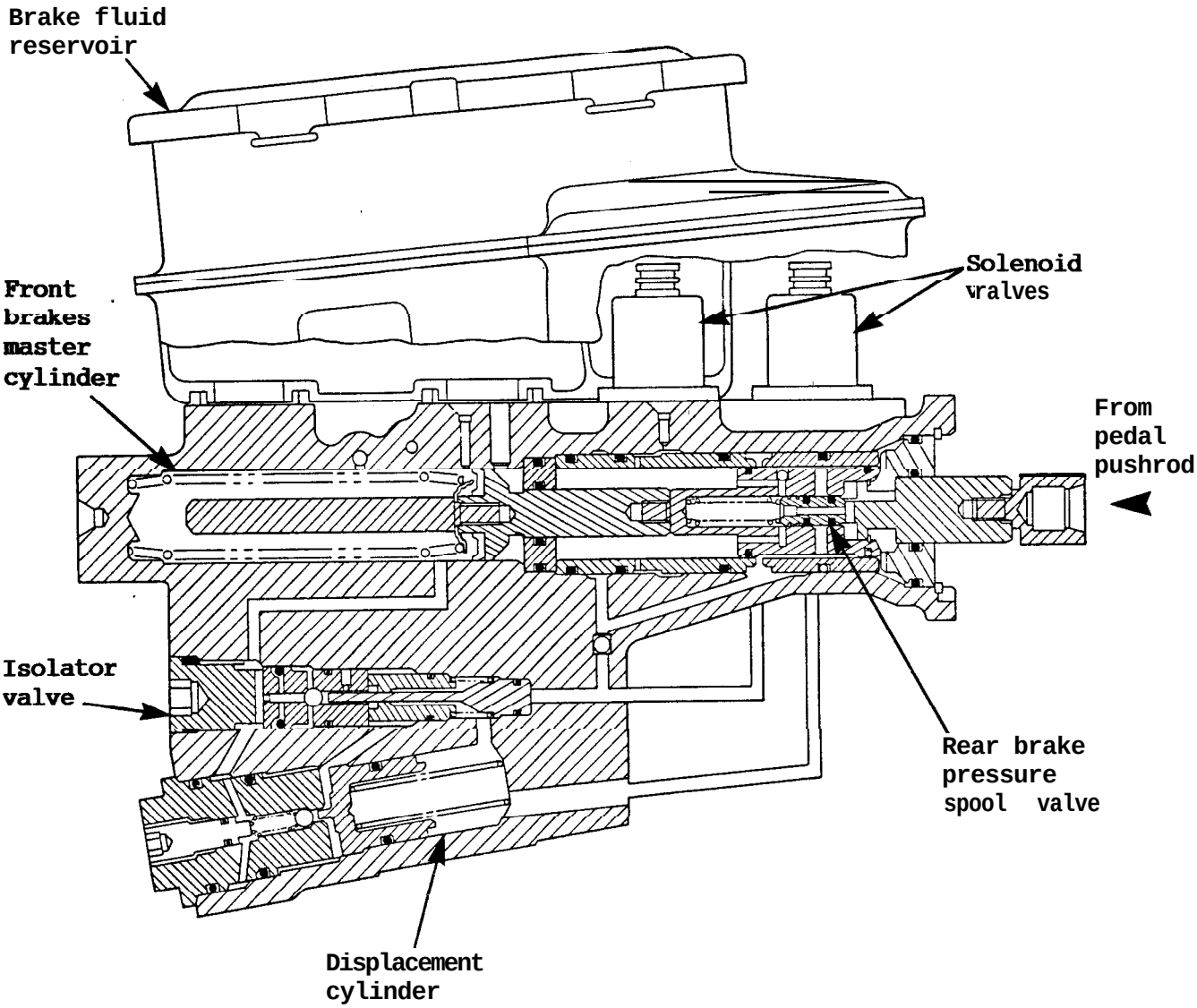
Displacement Cylinders: One for each front brake circuit, contained within the Powermaster IIIA, and not serviceable. Provide for reduction and reinstatement of line pressure during ABS operation without loss of pedal height.

Isolation Valves: One for each front brake circuit, contained within the Powermaster IIIA and not serviceable. Fitted between the master cylinder/front brake circuit and the displacement cylinder to limit the amount of pressure pulsation feedback to the brake pedal, and also to maintain manual unassisted front brake function in the event of boost pressure failure.

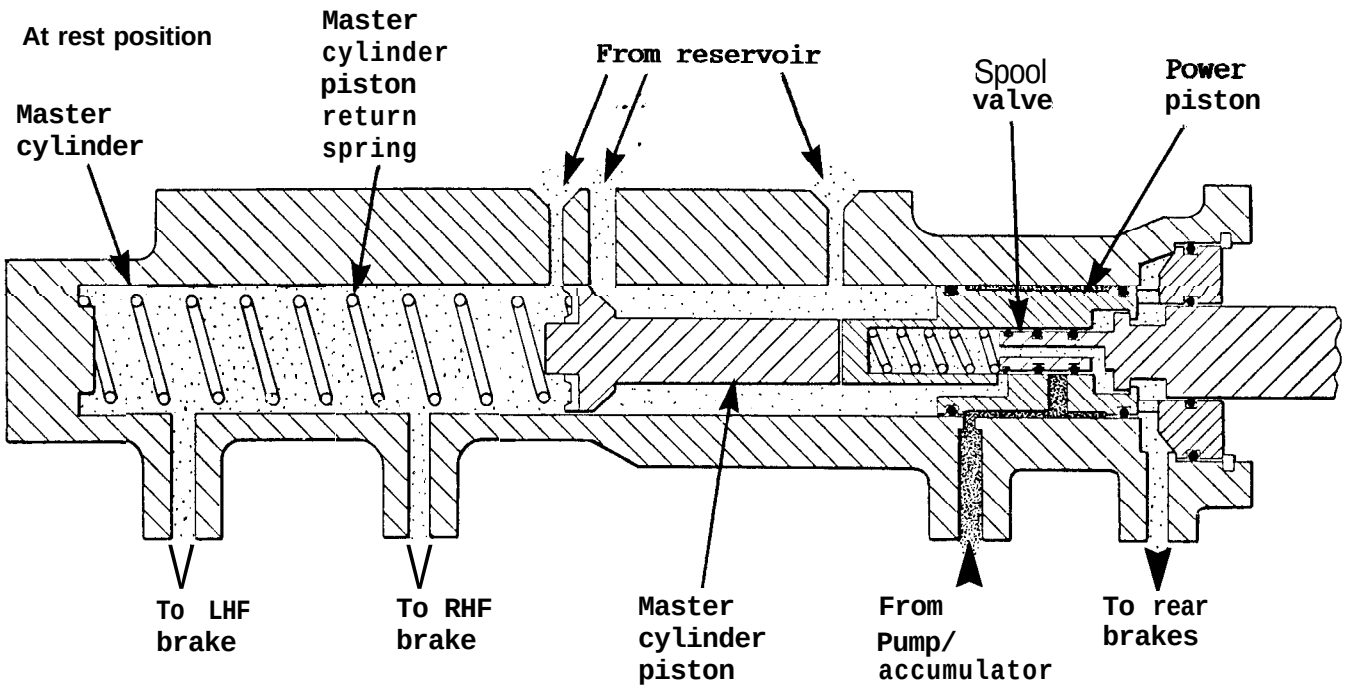
Proportioning Valve: Fitted only on cars with Bendix rear brakes. Single valve in rear brake circuit to control rear brake line pressure when ABS is not operating, and prevent over adjustment of rear caliper parking brake mechanism.

Powermaster IIIA Booster/Master Cylinder Assembly

The Powermaster IIIA booster/master cylinder assembly is mounted in the front luggage compartment, and is bolted through the bulkhead to the pedal box. The assembly provides brake line pressure to both front and rear circuits for normal (non ABS) braking, and modulated line pressure in ABS mode. The assembly contains a cylinder which houses a rear brake pressure spool valve, and a front brake circuit master cylinder, both of which are operated by the brake pedal pushrod. The main housing also contains the two displacement cylinders and isolator valves, and is topped by a fluid reservoir which also shrouds the three solenoid valves.

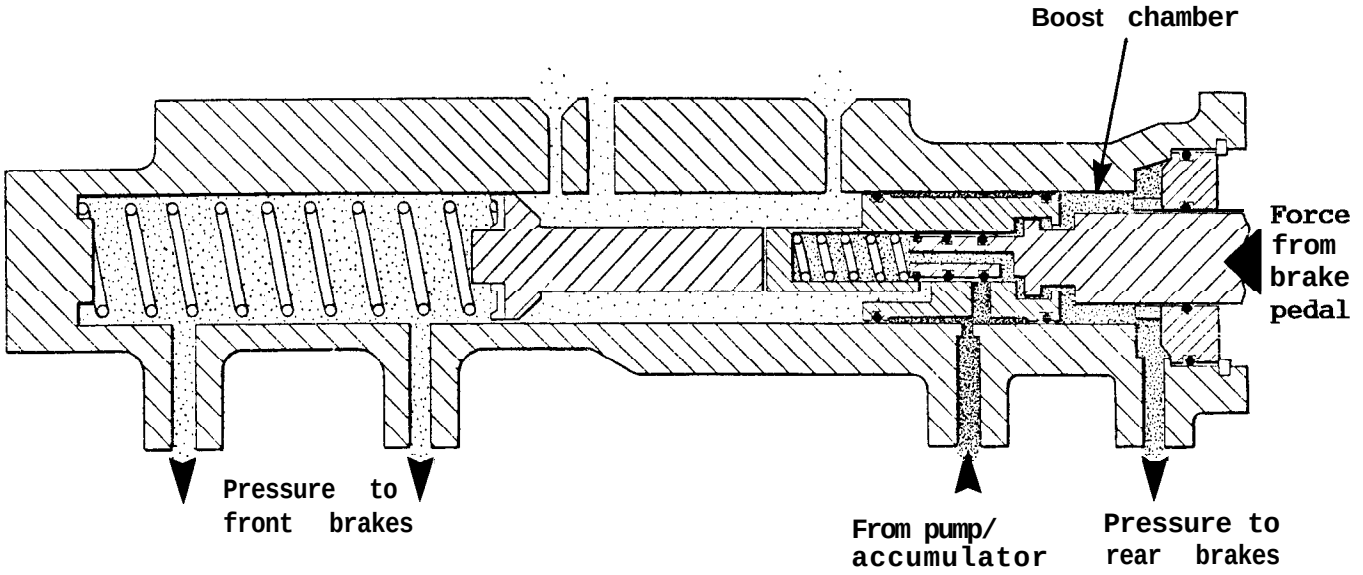


The rear brakes use a hydraulic circuit which is independent to that of the front brakes, and which also supplies the power assistance to the front brakes, and the ABS control circuit. Fluid at a pressure of approx. 17,000 kPa (2,500 lbf/in²) supplied by an accumulator pump (see below) is fed into the rear part of the Powermaster IIIA cylinder, to a spool control valve.



With no pressure applied to the brake pedal, the master cylinder return spring and spool valve return spring push the master cylinder piston, power piston and spool valve fully rear-wards, and open all chambers, except accumulator input, to atmospheric (reservoir) pressure.

Brakes applied



As the brake pedal is pressed, the spool valve moves to:
admit pressurised fluid into the boost chamber.
close the connection between reservoir and boost chamber;

Pressure in the boost chamber has three effects:
i) it applies the rear brakes;
ii) it acts on the spool valve to resist push rod movement and provide 'feedback' or 'feel';
iii) it pushes against the power piston to provide power assistance to the front brake master cylinder.

If the fluid pressure from the pump/accumulator is absent, the rear brakes will not apply, but direct contact between the spool valve, power piston and master cylinder piston, results in application of the front brakes without power assistance.

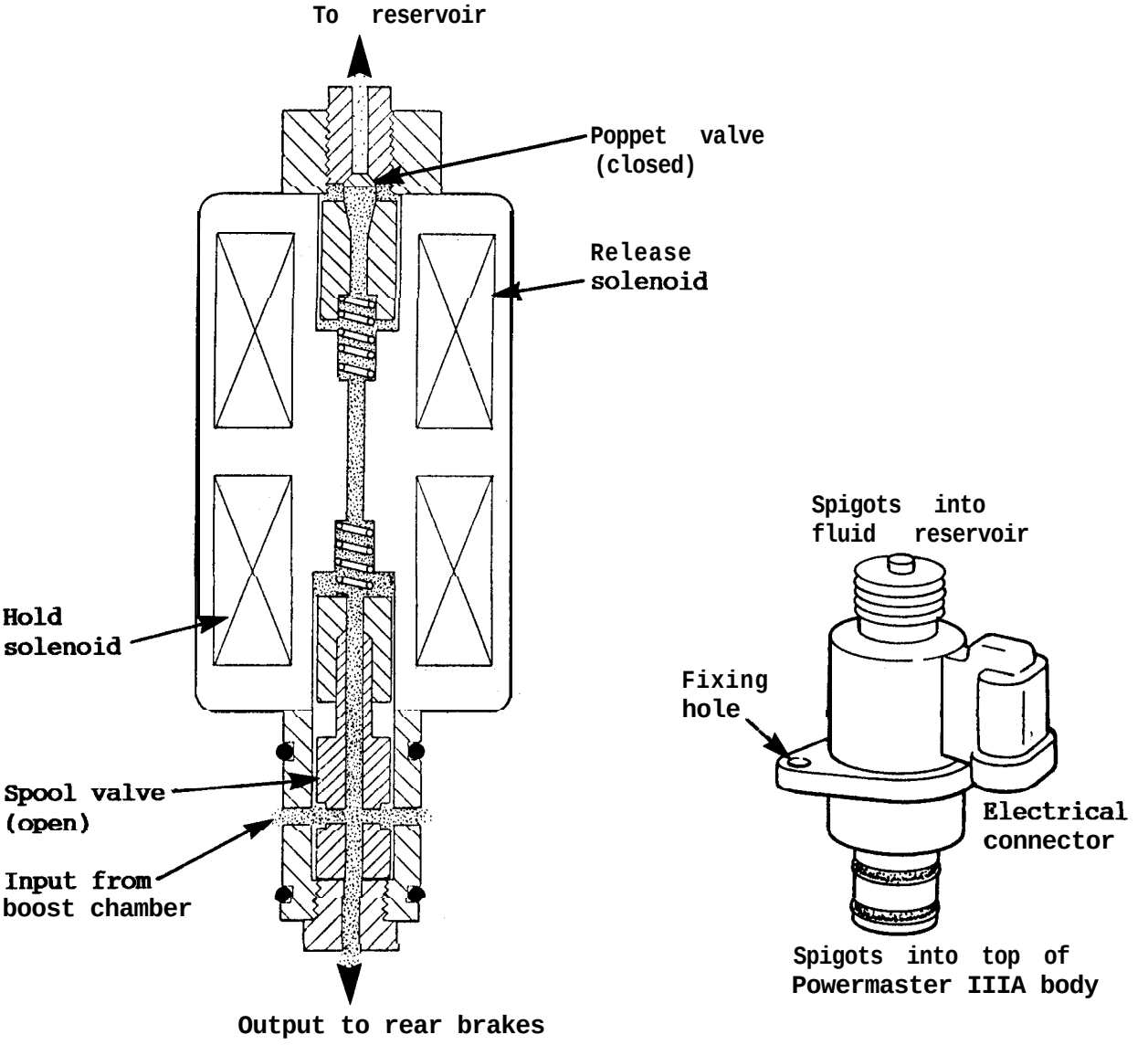
Rear Solenoid Valve

The rear solenoid valve is one of three located at the top rear of the Powermaster IIIA, shrouded by the fluid reservoir. The purpose of the solenoid valve is to modulate rear brake line pressure when wheel lock is detected by the ABS controller. The solenoid valve consists of two elements;

- a 'hold' solenoid controlling a normally open spool valve;
- a 'release' solenoid controlling a normally closed poppet valve.

Pressure apply mode

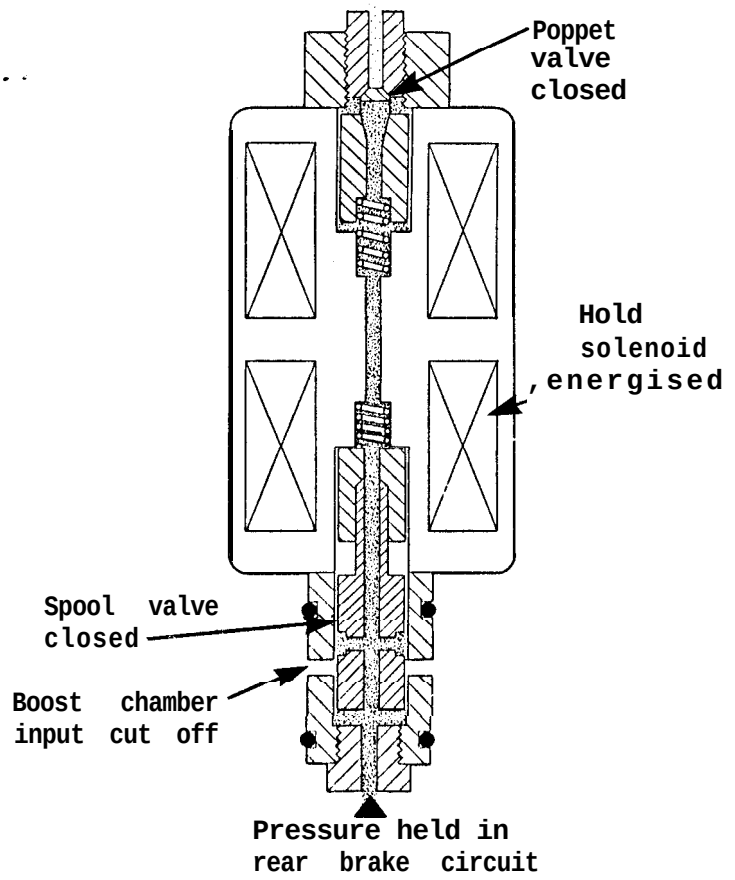
Under normal (non ABS) conditions, both solenoids are de-energised, so that the spool valve is open, and the poppet valve closed. Pressurised fluid from the boost chamber of the booster/master cylinder, flows through the spool valve and into the rear brake circuit.



Pressure hold mode

If either rear wheel begins to lock during braking, the ABS controller. grounds pin 1 C14, which energises the 'hold' solenoid and closes the spool valve.
The poppet valve remains closed.

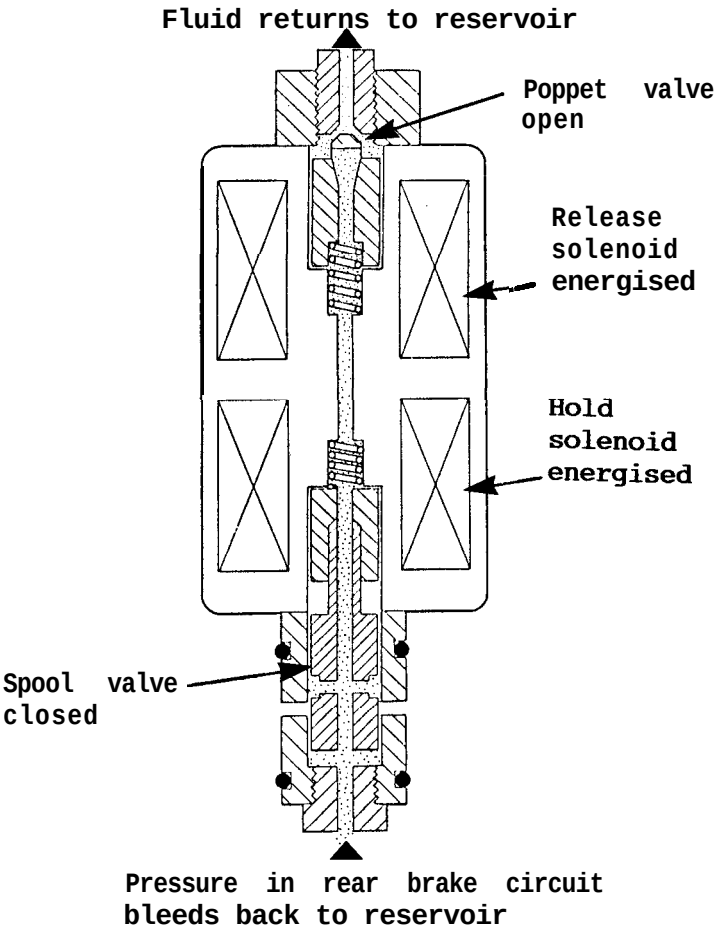
The rear brake circuit is isolated from the boost chamber, retaining the existing pressure but allowing no further increase.


Poppet valve closed
Hold solenoid energised
Spool valve closed
Boost chamber input cut off
Pressure held in rear brake circuit

Pressure release mode

If wheel lock is still occurring, the controller leaves pin 1 Cl4 grounded, but also toggles pin 1C15 to ground. This causes the poppet valve to open and release rear brake circuit pressure back to the reservoir.

When wheel speed has been regained, and the controller determines that a pressure increase is needed, both solenoid grounds are removed, the poppet valve closes, the spool valve opens, and the rear circuit is again connected with the boost chamber pressure.

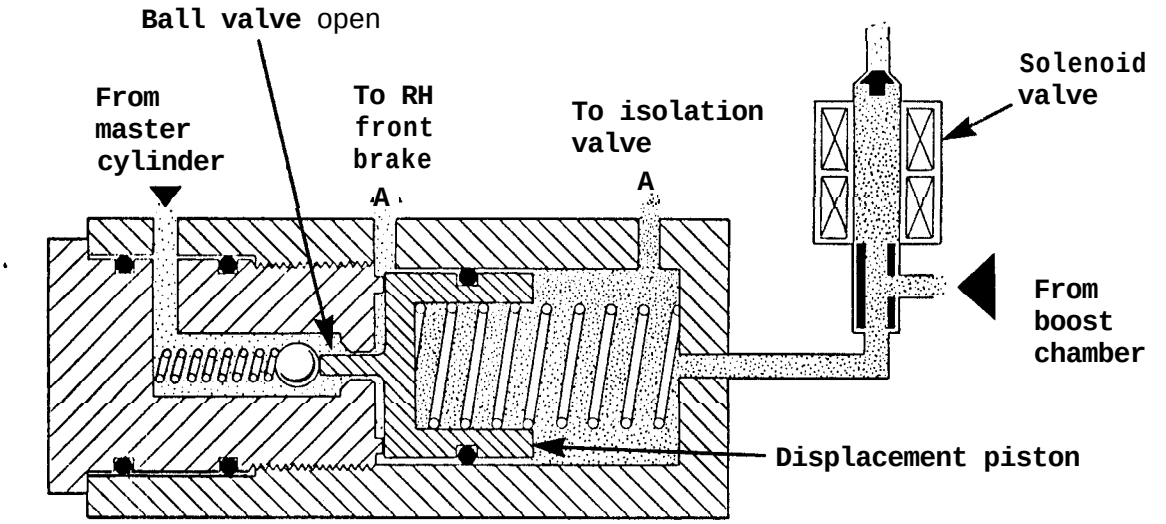

Fluid returns to reservoir
Poppet valve open
Release solenoid energised
Hold solenoid energised
Spool valve closed
Pressure in rear brake circuit bleeds back to reservoir

Displacement Cylinders

Two displacement cylinders are contained within the booster/master cylinder assembly, one for each front brake circuit. Each displacement cylinder is linked with a solenoid valve similar to that used on the rear circuit. The purpose of the displacement cylinder is to allow a pressure reduction and reinstatement during the course of ABS modulation, without losing brake pedal height. The following description of the RH circuit applies equally to the LH circuit.

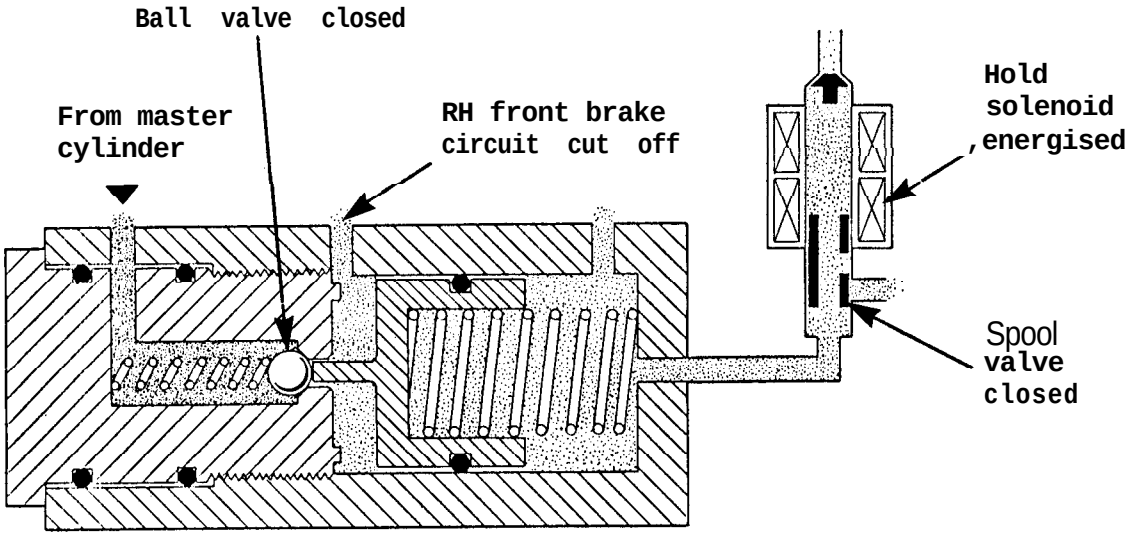
Rest & pressure apply mode

Under normal (non ABS) braking, both coils in the solenoid valve are de-energised, the spool valve is open, and pressurised fluid from the boost chamber flows through the spool valve to the underside of the displacement piston The piston is forced both by hydraulic and spring pressure against the end of the cylinder, and opens the spring loaded ball valve. Fluid from the front brake master cylinder is able to pass the ball valve and, flow to another RH front brake circuit ball valve controlled by the isolation valve (see later).



Pressure hold mode

If the ABS controller detects that the RH front wheel is beginning to lock, it grounds pin C6 to energise the RH front hold solenoid (D1 for LH solenoid).

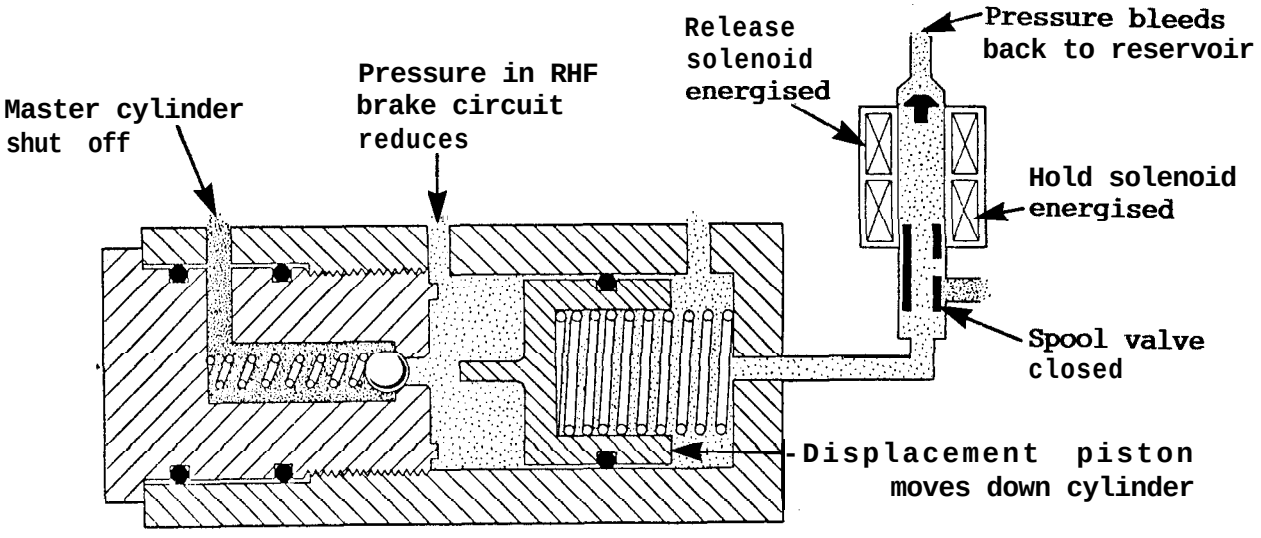


This causes the spool valve to shut off boost pressure from the underside of the displacement piston. If the master cylinder pressure continues to rise, the displacement piston is forced to move against its spring until the ball valve closes and shuts off-the master cylinder output line. Pressure in the front brake circuit then remains constant regardless of increasing pedal pressure.

Pressure release mode

If the ABS controller determines that pressure needs to be reduced to prevent wheel lock, it leaves pin C6 grounded (or D1 for left hand), and momentarily grounds pin C9 (C3 for LH).

This energises the release solenoid, and opens the poppet valve to allow the pressure at the underside of the piston to bleed off to the reservoir. As this pressure falls below brake line pressure, the piston is forced down the cylinder by fluid returning from the caliper, effecting a reduction in line pressure.


Master cylinder shut off
Pressure in RHF brake circuit reduces
Release solenoid energised
Pressure bleeds back to reservoir
Hold solenoid energised
Spool valve closed
Displacement piston moves down cylinder

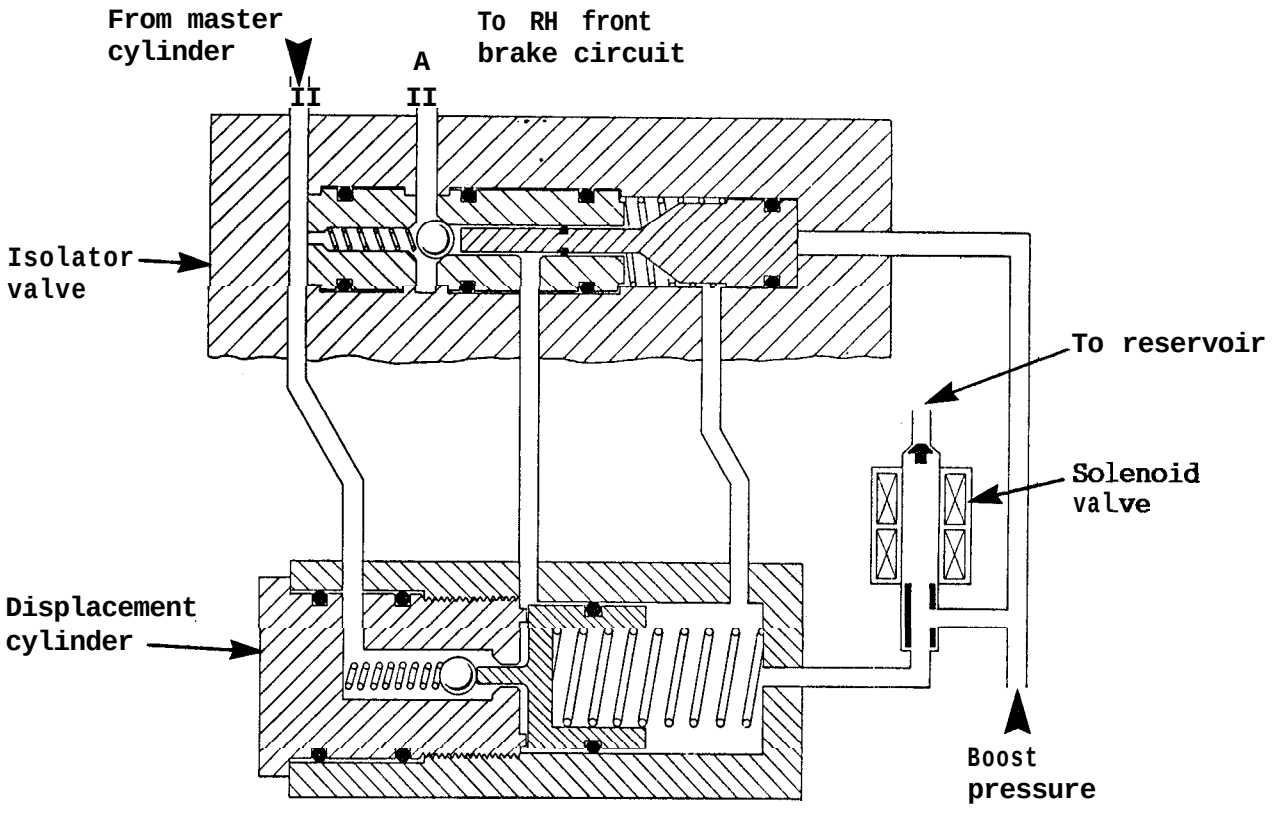
When pressure needs to be restored, the controller removes the earth from the two solenoids, allowing boost pressure to be readmitted to the underside of the displacement piston. The piston then moves back up the cylinder to pressurise the brake line, and return the displaced fluid back into the brake circuit. When fully returned, the piston opens the ball valve to connect the master cylinder with the brake line.

If the pedal is released when the displacement piston is down the cylinder, master cylinder pressure falls below brake line pressure, and fluid flows through the ball valve to return to the master cylinder. The displacement piston returns under spring pressure.

Isolation Valves

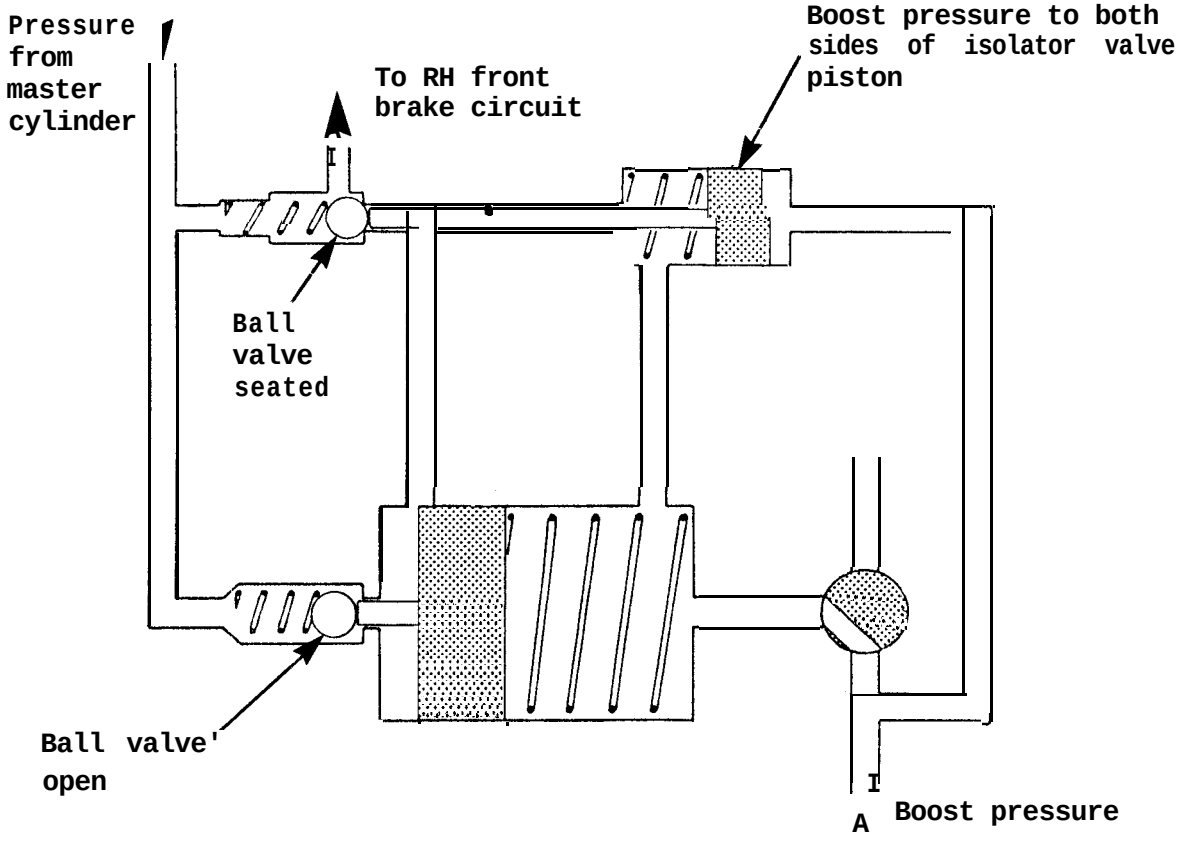
Each of the front brake circuits is equipped with an isloation valve to limit the magnitude of the pressure pulsations felt at the brake pedal when the anti-lock is operating, and to ensure that unassisted non-ABS operation may continue after failure of the hydraulic boost pressure. If the fluid pressure from the pump/accumulator is absent; when the brakes are applied, each front brake circuit displacement piston will be pushed back the small amount necessary for the ball valve to close, thus cutting off the front brakes.

The two valves (one for each front circuit) are housed within the booster/master cylinder assembly, are not servicable, and are connected between the master cylinder/front circuit and the displacement cylinders.



Normal mode

During normal non-ABS braking, boost pressure is applied to both sides of the isolation piston. The spring pushes the piston to the right, allowing the ball valve to be seated, so that fluid is free to pass from the master cylinder to the front brake circuit.



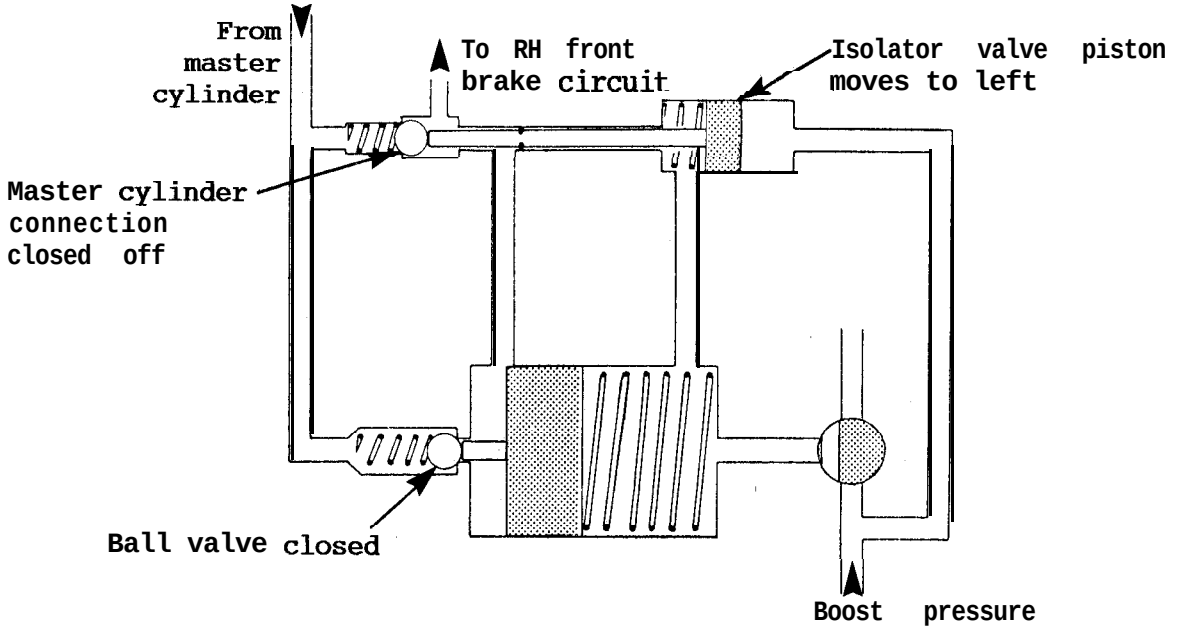
Hold mode

As soon as the controller determines that front wheel lock is occurring, and the solenoid spool valve has been activated to shut off boost pressure from the displacement cylinder, any further increase of pedal pressure results in the displacement piston ball valve closing as previously described, and due to the simultaneous increase in boost pressure, the isolation piston moving to operate its ball valve, thus:

shutting off the direct connection between master cylinder and RH front brake circuit;

opening the connection between displacement chamber and RH front brake circuit.

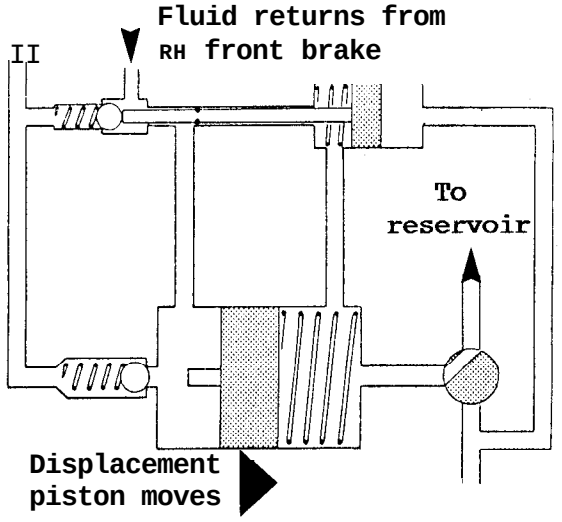
Pressure in the right hand front brake circuit remains constant regardless of increasing brake pedal pressure.


From master cylinder
To RH front brake circuit
Isolator valve piston moves to left
Master cylinder connection closed off
Ball valve closed
Boost pressure

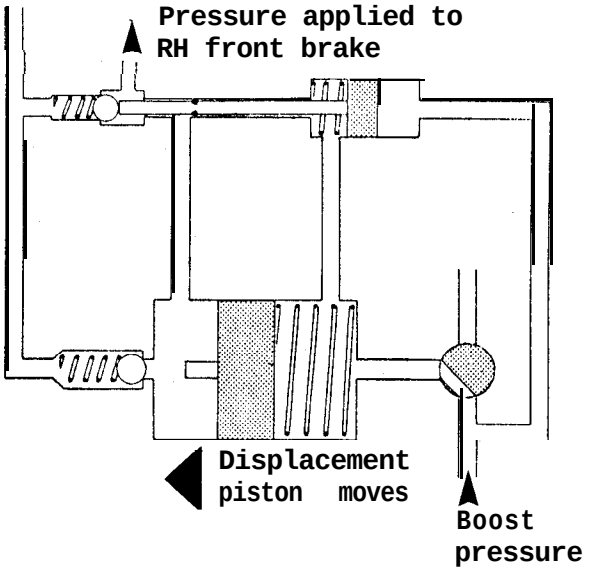
Pressure Release & Re-apply

If the ABS controller determines that pressure needs to be reduced to prevent wheel lock, the solenoid poppet valve is opened (see displacement cylinder operation) to bleed pressure from the underside of the displacement piston and allow it to move down the cylinder under the force of brake line pressure,

Pressure release



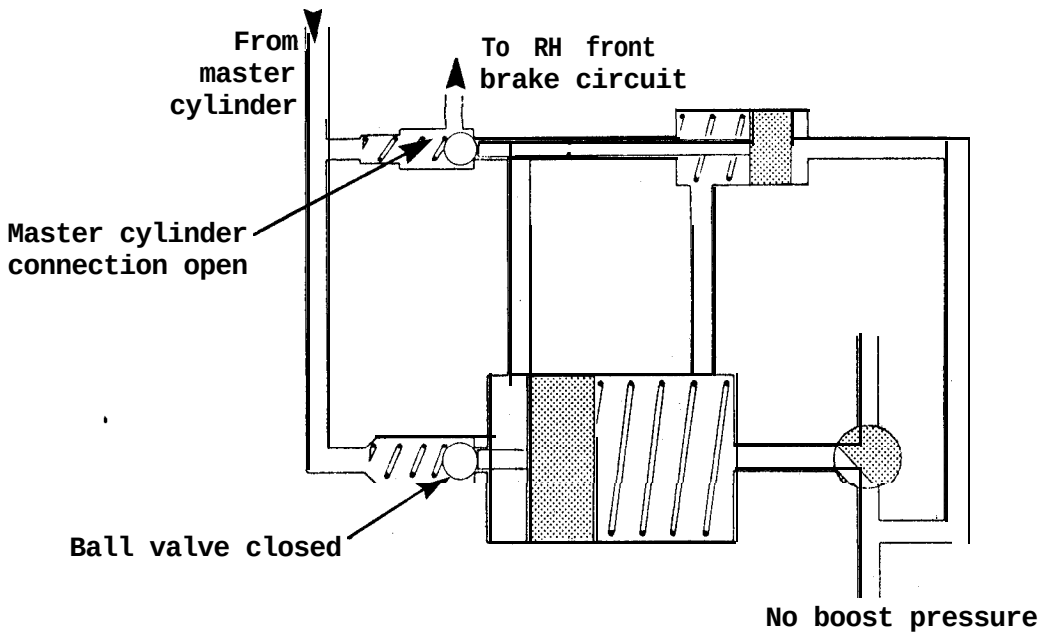
Re-apply



When pressure needs to be restored, boost pressure is re-admitted to the displacement cylinder to push the piston back and return the displaced fluid back into the brake line. When the displacement piston has fully returned, the pressure on the underside of the isolation piston becomes sufficient to release its ball valve and open the direct connection between master cylinder and RH front brake circuit.

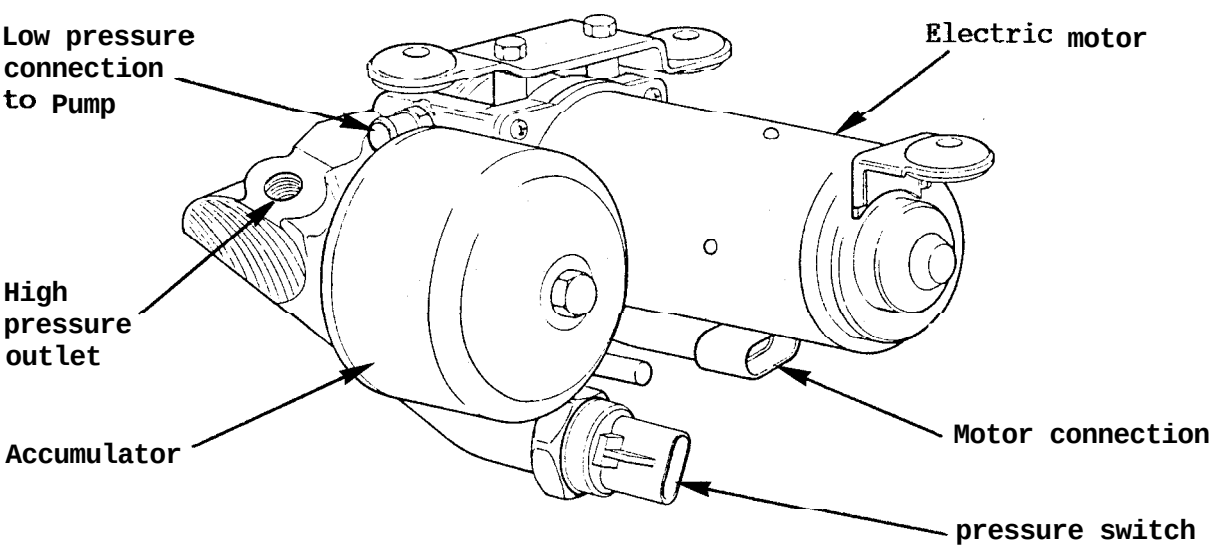
Accumulator Pressure Failure Mode

If no boost pressure is available, increasing pedal pressure will move the displacement piston sufficiently to close its ball valve, but the isolation ball valve will maintain the connection between master cylinder and brake circuit. Only unassisted non-antilock operation of the front brakes will be available in this condition.



Pump/Accumulator Assembly

The pump/accumulator assembly is rubber mounted to a support bracket at the driver's side of the front luggage compartment. The assembly consists of an electric motor, rotary pump, accumulator and pressure switch.

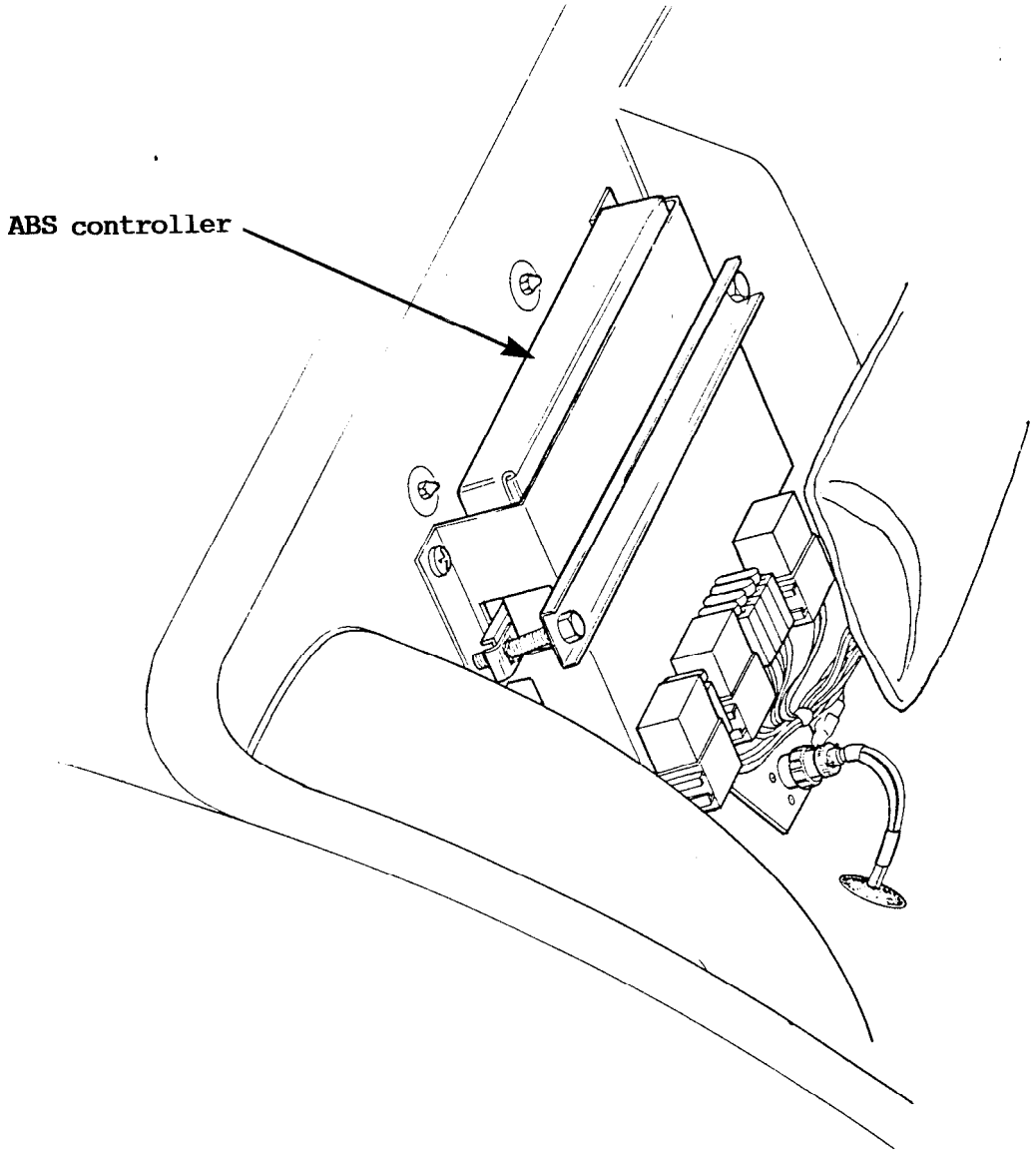


The motor turns the three piston rotary pump and supplies brake fluid under pressure to the accumulator where it is stored and maintained at a pressure of between 15,200 kPa and 18,600 kPa (2,200 and 2,700 psi). The accumulator stores pressurised fluid so that the pump does not need to run for three to five normal brake applications. A rubber diaphragm within the accumulator separates the fluid from nitrogen gas which is precharged to approximately 8275 kPa (1200 psi). A pressure switch fitted into the end cover of the pump/accumulator assembly closes below 15,200 kPa (2,200 psi) to energise the pump motor, and opens at 18,600 kPa (2,700 psi) to turn off the pump.

A pressure relief valve is fitted to prevent dangerously high pressures being produced in the event of a control system failure. The valve is fitted in the booster/master cylinder assembly and opens at a pressure of approximately 23,500 kPa (3,400 psi) to bleed excessive pressure back into the fluid reservoir. The valve reseals at approximately 18,600 kPa (2,700 psi).

Antilock Brake Controller

The antilock brake controller is a microprocessor mounted on the passenger side bulkhead in the front luggage compartment. The controller is the central component in the ABS, and its primary function is to monitor the speed of each wheel during braking, and determine whether any wheel is approaching lock up.



The controller monitors the status of the brake pedal switch, and receives signals from the four wheel speed sensors. When the brake pedal is depressed, and the brake switch is closed, the controller is alerted that the brakes have been applied, and monitors the four individual wheel speeds. If the controller detects that the deceleration of any wheel has exceeded a threshold value, or that a wheel or wheels are not decelerating equally, it will pulse the corresponding solenoid rapidly on and off to adjust the hydraulic pressure supplied to that brake and attempt to equalise the individual wheel deceleration rates. The pressure is modulated in each individual front circuit, and in the combined rear circuit according to the signal received from the rear wheel with the least grip. This type of ABS configuration is commonly called an 'Independent Front, Select Low Rear, 3-Channel System'.

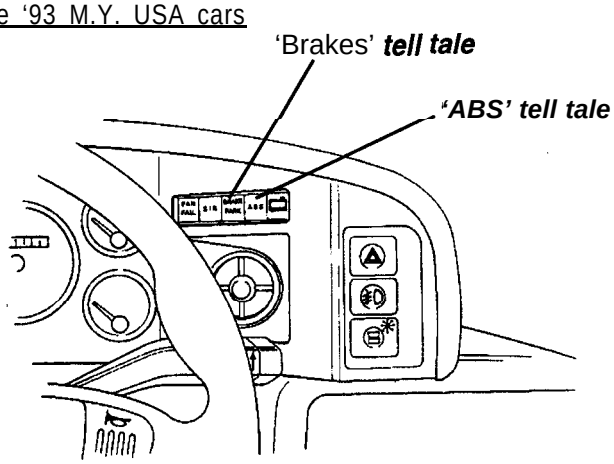
Self diagnostic capabilities

The antilock brake controller has diagnostic capabilities which allow it to detect malfunctions in itself or its related circuitry. The controller runs tests to detect malfunctions at different times during vehicle operation. For example, when the ignition is first switched on, a clicking sound can be briefly heard. This is the initialisation cycle, when the contoller cycles the enable relays and solenoids on and off in order to check for faults. While the vehicle is operating, the controller is constantly monitoring and performing tests on wheel speed data, accumulator switch status, and the condition of the solenoids and relays.

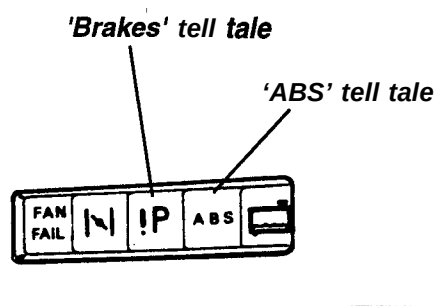
In the event that the controller detects a malfunction, the controller stores a diagnostic code and notifies the driver that a malfunction exists by lighting the ABS tell tale lamp. The ABS tell tale will flash if the detected problem does not immediately hamper ABS operation. However, a flashing ABS lamp indicates that repairs must be made to the system as soon as possible.

NOTE: PROLONGED VEHICLE OPERATION WITH A FLASHING ABS TELL TALE MAY FURTHER DAMAGE THE ABS AND MAY CAUSE COMPLETE ABS FAILURE.

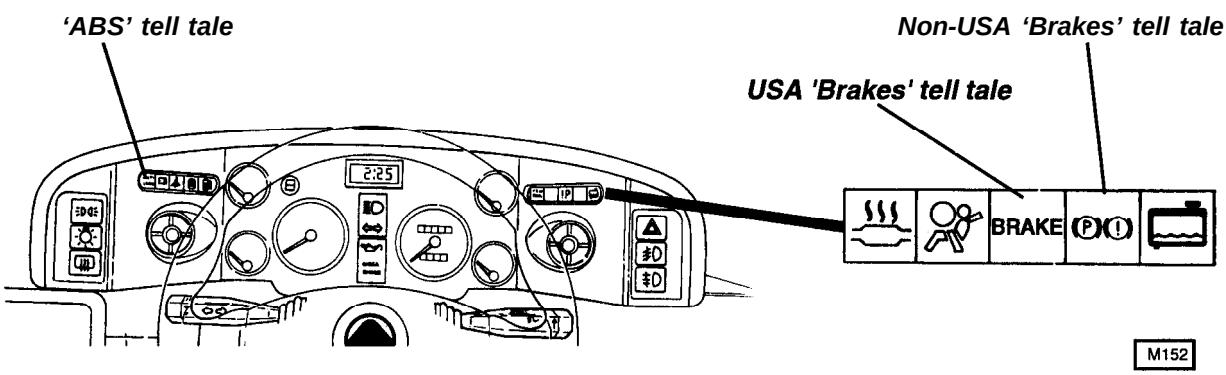
Pre '93 M.Y. USA cars



Pre '93 M.Y. non-USA araohics



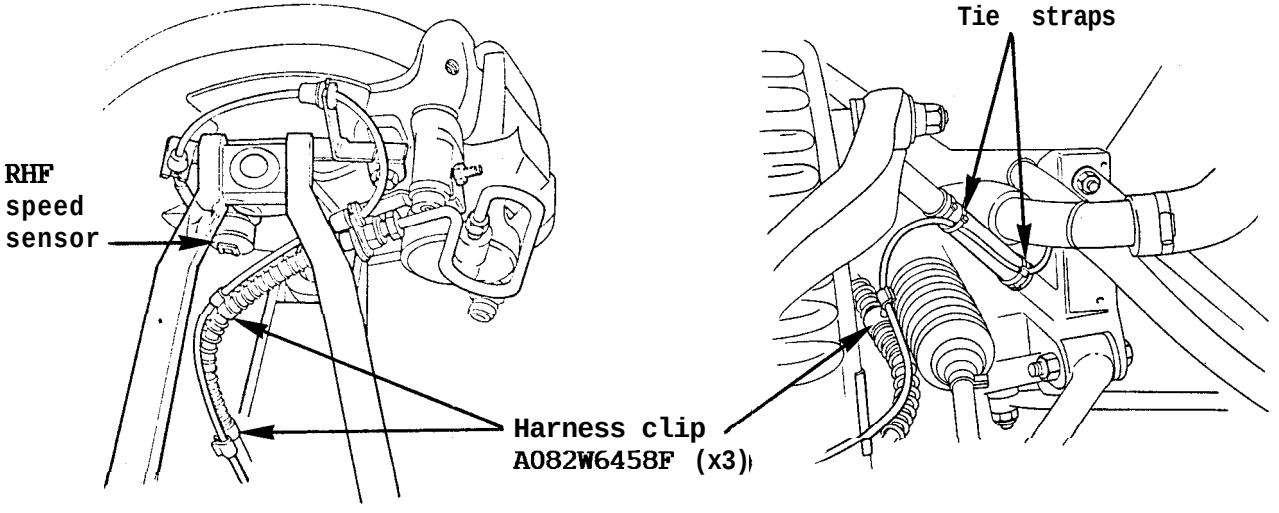
'94 M.Y. onwards



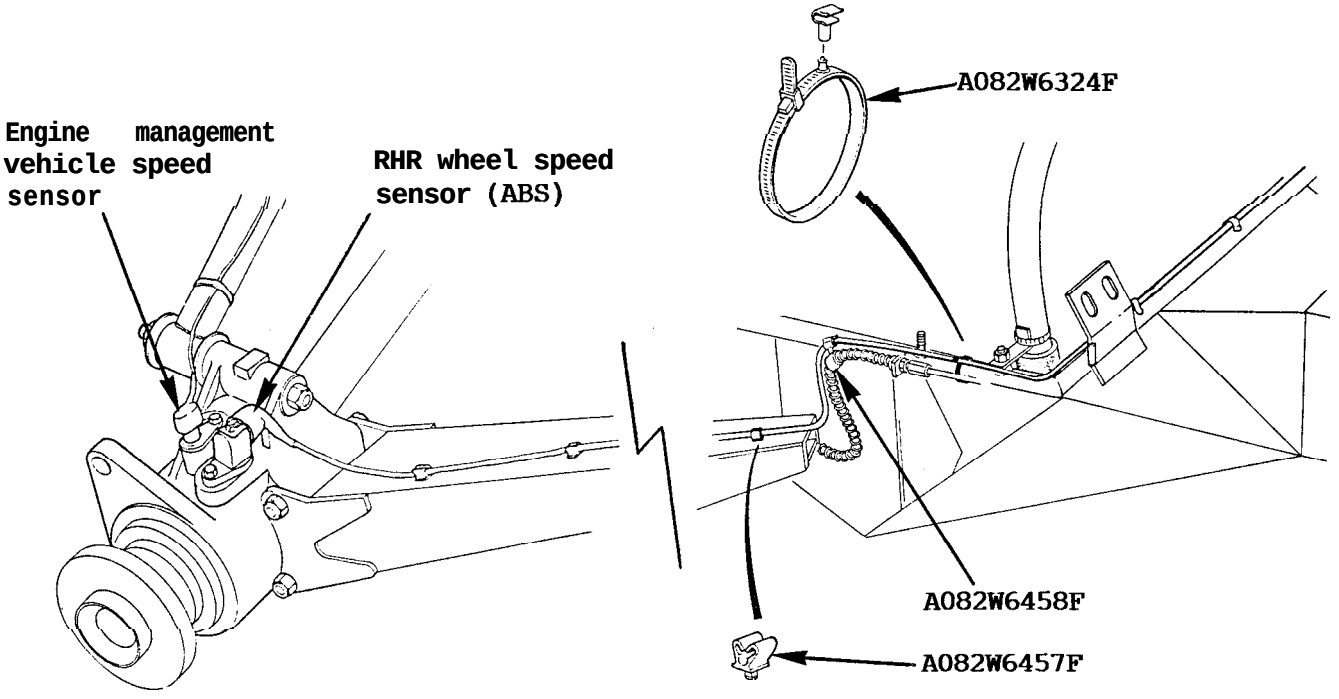
A solid ABS tell tale indicates that a problem has been detected that affects the operation of ABS. If the problem is determined to be in the portion that controls the two front wheels, the controller will shut down that part of the ABS, so that normal non anti-lock power assisted braking is available on the front wheels, with ABS continuing to operate on the rear wheels. If the problem is detected as being elsewhere in the system, the whole ABS will be shut down, with normal non anti-lock power assisted braking operating on all four wheels.

Wheel Speed Sensors

A wheel speed sensor is mounted on each of the four wheel hubs. The sensors for the front wheels are mounted on the brake disc shields which are themselves bolted to the hub carriers. A toothed ring pressed onto each front hub, passes close to the sensor, and generates a pulsing A.C. voltage, the frequency of which is a measure of the wheel speed.

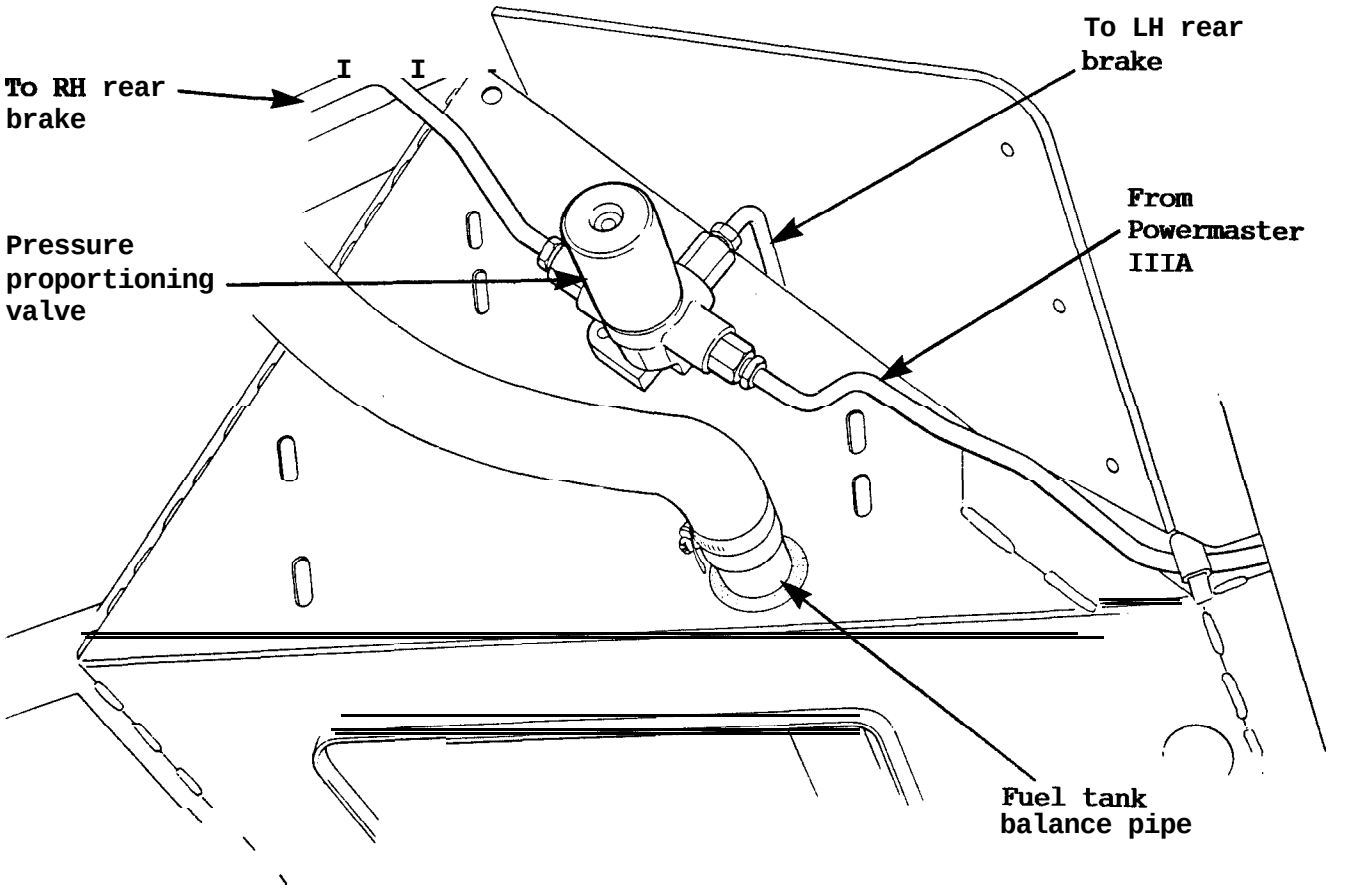


At the rear, the sensors are mounted on the hub carriers, and the toothed rings are integral with the driveshaft outboard C.V. joints. It is most important not to mix up the wheel speed sensors, or the engine management vehicle speed sensor also mounted on the RH rear hub carrier. See section JF.19 for identification.



Pressure Prooortionina Valve (TMC/Bendix brakes only)

If the brakes are vigorously operated when the accumulator is charged and the vehicle is stationary (at which time the ABS does not operate to control brake line pressure), the very high pressures produced in the boost chamber and rear brake circuit .could result in the rear brakes being applied with a force sufficient to overadjust the parking brake mechanism contained within the caliper piston. In order to prevent this possibility, and the consequent brake drag and pad wear, a pressure proportioning valve is fitted into the rear brake circuit, and is located at the right hand front of the engine bay.



The valve is designated 70/.1 which indicates:

i) at brake line pressures up to 70 bar, the valve has no effect, with input pressure equal to output pressure from the valve.

ii) as input pressure increases above 70 bar, the rise in output pressure is limited to 0.1 of the input pressure increase.

JF.14 - HYDRAULIC DIAGNOSIS

CAUTION: The 'Tech 1' scanner tool **MUST** be used to check for fault codes (see section JF.25) before attempting **ANY** of the following diagnostic procedures. The diagnostic codes of the **DM ABS-IIIA** system help pinpoint problem components or areas. The following tests should only be used if a diagnostic chart directs the technician to this section or a problem exists, but no codes have been set.

ABS. IIIA DIAGNOSTIC CODE TO HYDRAULIC DIAGNOSIS TEST REFERENCE CHART

TEST TO BE PERFORMED	FAULT CODE (see section JF.25)							
	A023 A024 A025	A026 A027 A028	A061 A035	A044 A045 A046 A047	A048 A049 A050 A051	A056	A059	A062
Inspect	1	1	1	1	1	1	1	1
A. ABS Release Function Check	2					6		
B. ABS Hold Function Check		2				5		
C. Low or No Boost Pressure Check			2			2	3	
D. Pump Run Time Too Long			3				4	
E. Pump Off Time Too Short						3		
F. External Leakage Check						4	2	
G. Pump Motor Operation								2

IMPORTANT: If referred to this section from a section JF.25 diagnostic code, complete the tests noted below the appropriate code number in numerical order. For example, if referred to this section from code A023, first complete the inspect steps (1) and then the ABS Functional Check (2). If using this section because the ABS-IIIA system is malfunctioning, but no codes have been set, complete the following tests **in the order in which they appear.** BEGIN DIAGNOSIS IN THIS SECTION WITH THE INSPECT STEPS.

INSPECT

1. Fluid level when system is depressurized. To depressurize the unit, turn off the ignition or disconnect the battery. Then **FIRMLY** apply and release the brake pedal a minimum of 40 times. The accumulator is discharged when a hard pedal feel is obtained.

2. Brake lines, brake hoses, master cylinder/booster assembly, pump/accumulator assembly and brake calipers for leakage.

3. Brake lines, and brake hoses for excessive wear, heat damage, punctures, tears, interference with other parts, missing clips or holders, poor connections or blockage.

4. Calipers and caliper pins for rust or corrosion.

5. Calipers for proper sliding action.

6. Caliper pistons for movement during brake application and sufficient retraction upon brake release.

7. Front speed sensors for proper mounting and connections.

a. Front speed sensor rings for broken teeth or poor mounting.

9. Front speed sensor ring air gap. Gap should be 0.6 - 1.4 mm (0.025 - 0.055 in.) and is adjustable by shims.

10. Rear speed sensor connections.

1 1. Rear speed sensors for proper installation or damage.

12. Brake pedal travel after system is depressurized. Pedal should NOT bottom near the floor. See section JF.3 - ABS Brake Characteristics.

13. Worn or missing isolator bushings on the pump/accumulator mounting bracket which may cause objectionable pump motor noise.

14. High pressure line on Powermaster IIIA which may be rubbing against other engine compartment parts.

Amber 'ABS' Tell Tale Lamp

If the amber ABS tell tale lamp stays on after the initial bulb check, or lights during a brake application, see section JF.25 for diagnosis.

Red 'Brakes' Tell Tale Lamp

If the red brake warning lamp stays on after the initial bulb check, possible causes include: parking brake applied; malfunctioning parking brake switch; wiring; low fluid level; malfunctioning fluid level sensor; loose or damaged connectors or wiring; low accumulator pressure.

1. Turn ignition off.

2. Fit 'Tech 1' scanner tool to ALDL connector (see section JF.25).

3. Turn ignition on. Using scan tool, read brake pressure state.

4. If brake pressure is OK, (1600 psi or greater) go to step 6. If brake pressure is low (not OK), scan controller for codes.

5. If no codes are found, continue performing hydraulic diagnosis tests beginning with test A. (ABS System Functional Check)

6. Disconnect fluid level sensor connector from the reservoir. Apply foot brake and completely release parking brake.

7. Does the red 'brakes' tell tale lamp stay on? If so, check the parking brake switch, wiring and connectors.

a. If the parking brake switch, wiring and connectors are good, inspect the wiring and connectors to the fluid level sensor.

9. Connect the fluid level sensor connector. Does the red 'brakes' tell tale lamp light? If so, check for low fluid level, external leaks or malfunctioning fluid level sensor.

A. ABS RELEASE FUNCTION CHECK

Test Description: While manually operating the system, this test determines whether the system applies braking force to all the wheels AND allows a wheel to rotate when the ABS reduces brake pressure to that wheel.

Symptoms: Wheel lock during braking; vehicle pulls to one side.

Possible Causes: Caliper or parking brake stuck; low or no boost pressure; master cylinder malfunction; loose or damaged wires or connectors.

1. Fit 'Tech 1' scanner tool to the ALDL connector.

2. Have assistant sit in the driver's seat to operate the brakes and scanner tool during the following procedures.

3. Raise vehicle on a lift.

4. Turn on ignition. Put transmission in neutral. Do NOT apply brakes. Try to rotate each wheel. If all wheels do not rotate, check operation of the parking brake and brake calipers.

   NOTE: The front wheels should turn with little or no resistance. However, the rear wheels will have some resistance to rotation caused by the differential and transmission. 'No wheel rotation' exists when a wheel cannot be turned using hand force.

5. Apply medium pressure to the brakes. Again try to rotate each wheel. No wheel should rotate.

6. If either of the front wheels rotate, replace the master cylinder/booster assembly because the master cylinder is malfunctioning.

7. If the rear wheels rotate, a low or no boost pressure condition exists. See test C. (Low or no Boost Pressure Check)

a. Have assistant apply the foot brake moderately and using the 'Tech 1' tool, energize the release solenoid for a specific wheel. Test wheel rotation for the appropriate solenoid and:
   - listen for the sound of fluid being forcefully sprayed in the reservoir; - note pedal travel;
   - note whether the pump runs constantly or at frequent intervals while the solenoids are energized. Test other release solenoids in the same way.

   NOTICE: During this test, the Powermaster IIIA master cylinder/booster assembly will not reduce brake line pressure to zero psi. Approximately 10 psi will be left in the brake lines under these conditions. Therefore, some drag may be noticed when testing wheel rotation. This drag is normal and should not be confused with a wheel that does not rotate (cannot be turned with hand force).

9. With the release solenoid for a specific wheel energized, the respective wheel should rotate. In addition, while the solenoid is energized: it should not be possible to hear fluid being forcefully sprayed in the reservoir; the brake pedal should not steadily sink to the floor; the pump should not run constantly or frequently.

10. If any deviations are noted in test 9, check the wiring and connections to the appropriate solenoid. If necessary, replace the Powermaster IIIA wiring harness if any of the wires or connections to the appropriate solenoids aredamaged. Perform steps 8 through 10 again.

1 1. If test 9 results are still unsatisfactory, replace the respective solenoid and perform steps 8 through **10** again.

12. If test 9 results are still unsatisfactory, replace the master cylinder assembly.

B. ABS HOLD FUNCTION CHECK

Test Description: This test checks the hold function of the ABS system.

Symptoms: Vehicle pulls to one side; accumulator pressure exhausts during an ABS stop (red 'brakes' tell tale comes on); wheel locks during braking; consistently rough stops.

Possible Causes: Solenoids leaking or malfunctioning; master cylinder/booster assembly malfunctioning.

1. Fit 'Tech 1' scanner tool to the ALDL connector.

2. Have assistant sit in the driver's seat to operate the brakes and scanner tool during the following procedures. Keep transmission in neutral throughout test.

3. Raise vehicle on a lift.

4. Turn on ignition and allow unit to pressurize.

5. Using the 'Tech 1', test the hold function of the rear brakes by energizing only the rear hold solenoid. Then apply the brakes moderately. Listen for the sound of fluid being forcefully sprayed in the reservoir, note pedal travel and note whether the pump runs constantly or at frequent intervals while the solenoid is energized.

6. With the rear hold solenoid energized, try to turn a rear wheel. The wheel should turn with only differential and transmission resistance for 6 or more seconds before the brakes begin to apply. In addition: it should not be possible to hear fluid being forcefully sprayed in the reservoir; the brake pedal should not steadily sink to the floor; and the pump should not run constantly or frequently. If the rear brakes apply in 5 seconds or less, or if there are any other deviations from the above conditions, replace the rear solenoid and perform steps 5 and 6 again.

7. If the brakes still apply in 5 seconds or less or if test 6 results are still unsatisfactory, replace the master cylinder/booster assembly.

8. Moderately apply the brakes. Using the 'Tech 1' tool, test the hold function of one of the front wheel brakes. While the solenoid is energized, listen for the sound of fluid being forcefully sprayed in the reservoir, note pedal travel and note whether the pump runs constantly or at frequent intervals. Test the hold function of the other front hold solenoid in the same way.

9. Try to turn the appropriate front wheel. The wheel should turn freely for 6 or more seconds before the brake begins to apply.
In addition: it should not be possible to hear fluid being forcefully sprayed in the reservoir; the brake pedal should not steadily sink to the floor; and the pump should not run constantly or frequently.
If the rear brakes apply in 5 seconds or less, or if there are any other deviations from the above conditions, replace the appropriate front solenoid and perform steps 8 and 9 again.

10. If the brake continues to apply in 5 seconds or less. or test 9 results are still unsatisfactory, replace the master cylinder/booster assembly.

C. LOW OR NO BOOST PRESSURE CHECK

Symptoms: Red 'brakes' tell tale lamp lit: amber ABS warning lamp lit: frequent pump running; pump not running.

Possible Causes: Internal master cylinder/booster assembly leak; malfunctioning check valve; malfunctioning pump; malfunctioning pump relay; malfunctioning pressure switch; fuse blown; loose or damaged wiring; low fluid level (boost side); reversed polarity at motor (motor runs backwards); reversed polarity at relay coil (motor won't run).

1. Turn off ignition and depressurise the accumulator.

2. Fit 'Tech 1' scanner tool to ALDL connector.

3. Perform an 'ABS pump power up test' using the Tech 1

4. Note the **TOTAL** pump run time. This is the time between ignition on and pump shut off. (If the pump does not run, see section JF.25)

5. If the total pump run time is 40 seconds or less, the system is developing satisfactory boost pressure. If the total pump run time is more than 40 seconds, see test D. (Pump Run Time Too Long)

6. Determine the pump off time by moderately applying the brakes and holding the brake pedal in the applied position. The pump off time is the time between brake apply and pump run. (Pump run test may also be performed via 'Tech 1')

7. If the pump off time is 50 seconds or less, a problem may exist in the master cylinder/booster assembly. See test E. (Pump Off Time Too Short).
If the pump off time is more than 50 seconds, the master cylinder/booster assembly is adequately holding boost pressure.

D. PUMP RUN TIME TOO LONG

Symptoms: Pump run time from no pressure to the high limit switch point takes longer than 40 seconds.

Possible Causes: Defective battery; malfunctioning charging system or electrical circuits other than ABS circuits; low accumulator precharge; pressure switch malfunctioning; damaged master cylinder/booster assembly; malfunctioning pump; low fluid level (boost side).

1. Turn off ignition. Disconnect wiring harness at the pump connector. Turn on ignition. Using a digital volt/ohmeter, check voltage of Pin A to ground.

2. If less than 12 volts exist at Pin A, check the battery, charging system and non ABS electrical circuits for damage.

3. Turn off ignition. Reconnect pump harness. Depressurise the accumulator.
WARNING: Ensure the accumulator is fully depressurised (apply brake pedal hard and release up to 40 times with ignition off) before removing accumulator.

Remove accumulator and install pressure gauge T000T1 112. Install accumulator on pressure gauge adaptor.

4. Turn ignition on to let pump run for 15 seconds. Turn ignition off and apply the brake pedal hard and release up to 40 times to de-pressurise accumulator.

5. Observe pressure gauge while turning on ignition. Is there a sudden jump in pressure from 0 psi to 500 psi or more almost immediately after the ignition is turned on? (This initial jump in pressure is the amount of accumulator precharge). If not, the accumulator must be replaced because the precharge is too low.

6. Note pressure when the motor shuts off or a high pressure limit is reached. Is this pressure more than 2,900 psi? If so, replace the pressure switch.

7. Using the 'Tech 1', monitor the pump state while applying the brakes slowly until the pump begins to run. Note the low pressure point when the pump turns on.

a. Does the motor turn on at 2,000 to 2,400 psi? If not, replace the pressure switch since it is turning on the motor at too low a point. DEPRESSURISE the accumulator before removing the switch.

9. If the pressure switch functions properly, visually check the pump outlet in the reservoir to ensure it is not blocked. DO NOT APPLY THE BRAKES WITH THE RESERVOIR COVER REMOVED. If the outlet is clear, attach one end of a clear plastic hose over the relief valve in the reservoir. Hold the other end of the tube (pointing downward) in the rear reservoir chamber and turn on the ignition. If fluid flows through the tube into the reservoir, the relief valve is leaking and should be replaced. If fluid does not flow through the tube, replace the master cylinder/booster assembly.

E. PUMP OFF TIME TOO SHORT

Symptom: Pump is off for too short a period of time causing pump to cycle frequently.

Possible Causes: Excessive internal leakage; low precharge accumulator; leaking solenoid(s); damaged master cylinder/booster assembly.

1. Turn off ignition. Depressurise the accumulator.

WARNING: Ensure the accumulator is fully depressurised (apply brake pedal hard and release at least 40 times with ignition off) before removing accumulator.

Remove accumulator and install pressure gauge TOOOT1112. Install accumulator on pressure gauge adaptor.

2. Turn ignition on to let pump run for 15 seconds. Turn ignition off and apply the brake pedal hard and release up to 40 times to de-pressurise accumulator.

3. Observe pressure gauge while turning on ignition. Is there a sudden jump in pressure from 0 psi to 500 psi or more almost immediately after the ignition is turned on? (This initial jump in pressure is the amount of accumulator precharge). If not, the accumulator must be replaced because the precharge is too low.

4. Allow the system to pressurise until the pump shuts off. With ignition still on, determine the pump off time by moderately applying the brakes and holding the pedal in the applied position. The pump off time is the time between brake apply and pump run. (Pump run test may also be performed via 'Tech 1')

5. Refer to the chart below to determine whether the accumulator or master cylinder/booster assembly should be replaced. If pump off time is less than 50 seconds, check accumulator precharge. If accumulator precharge is less than 600 psi, replace the accumulator. If precharge is 600 psi or greater and the pump off time is less than the corresponding chart value, replace the master cylinder/ booster assembly.

Accumulator Precharge (psi)	Pump Off-time (seconds)
1200	60
1100	55
1000	50
900	45
800	40
700	35
600	30
Less than 600	Replace accumulator

F. EXTERNAL LEAKAGE CHECK

Symptom: Any dampness or dripping of brake fluid on the master cylinder/booster assembly, pump/ accumulator assembly, brake lines, proportioning valve or calipers.

Possible Causes: Leaking O-ring seal(s), poor connections, over-filled front chamber of reservoir.

1. Depressurize the accumulator.

2. Clean and remove the reservoir cover and diaphragm assembly. Check the fluidlevels.

3. If the front reservoir chamber level is high, drain fluid to restore proper level.

4. If the rear chamber fluid level is high, drain fluid to restore to proper level. A high rear chamber fluid level may be caused by filling the reservoir without depressurising the system.

5. Clean and dry the master cylinder/booster assembly, pump/accumulator assembly and other brake system parts so that the source of a leak may be more easily detected.

6. Install the reservoir cover and diaphragm assembly.

7. Turn on the ignition and pump the brakes. Check for leaks. Tighten any loose connections. Repair calipers or brake lines as necessary. If leakage occurs on the master cylinder/booster assembly, tighten connections if possible, or replace the unit. Depressurize the accumulator and check the fluid levels in the reservoir chambers.

8. If the level in the front reservoir chamber is high, see G (Fluid Leaking into Front Chamber). If the level in the rear reservoir chamber is high, replace the master cylinder/booster assembly.

G. PUMP MOTOR OPERATION

1. Turn off the ignition and depressurise the accumulator.

WARNING: Ensure the accumulator is fully depressurised (apply brake pedal hard and release up to 40 times with ignition off) before removing the accumulator.

Remove the accumulator and install pressure gauge T000T1112. Install accumulator on the pressure gauge adaptor.

2. Turn on the ignition and allow the pump to run for at least 20 seconds. Turn off ignition and check for leaks, correcting as necessary. Depressurise the accumulator.

3. Using the 'Tech 1' tool, perform the 'Total Pump Run Time Test'. Observe the pressure gauge while turning on the ignition. Is there a sudden jump from 0 to 3500 kPa (0 to 500 psi) or more almost immediately after the ignition is turned on? (This initial jump in pressure is the amount of accumulator precharge) If not, and the pump motor is running, perform step 9 of test D 'Pump Run Time Too Long'. If the jump in pressure is to less than 4150 kPa (600 psi), replace the accumulator.

4. Note the pressure at which 'Tech 1' indicates "OK" pressure. If this pressure is not within the 11,700 to 13,100 kPa (1700 to 1900 psi) range, replace the accumulator pressure switch. Note the pressure at which the pump turns off. If it is not within the 17,900 to 20,000 kPa (2600 to 2900 psi) range, replace the accumulator pressure switch. If the pump continues to run but maintains a constant pressure, perform step 9 of test D 'Pump Run Time Too Long'.

NOTE: When depressing the brake pedal to cause the pump to run, press the pedal slowly and carefully until the pump just begins to run. Do not continue to press the pedal after the pump begins to run, or pump run times which are too short may be missed.

5. When the pump has stopped, press the brake pedal until the pump begins to run. If this pressure is not within the 14,150 to 15,850 kPa (2050 to 2300 psi) range, replace the accumulator.

6. If: accumulator pressure switch points are al! within range, and; accumulator precharge is greater than 4150 kPa (600 psi), and; battery voltage is greater than 11.8 volts when the pump is running: if the total pump run time is greater than 40 seconds, replace the pump and motor assembly.

H. FLUID LEAKING INTO FRONT CHAMBER

Symptom: Front reservoir chamber becomes overfilled causing leakage past the reservoir cover.

Possible Causes: Reservoir cover and/or diaphragm leaking; damaged master cylinder/booster assembly.

1. Depressurise the accumulator.

2. Drain brake fluid in the front reservoir below the divider between the two master cylinder ports.

3. Install the reservoir cover and diaphragm assembly. Turn on the ignition and pump the brakes several times.

4. Again depressurise the accumulator. Remove the reservoir cover and diaphragm. Note the level of fluid in the front reservoir.

5. If the fluid level has risen in the front chamber, replace the master cylinder/booster assembly.

6. If the fluid level drops or stays the same, replace the reservoir cover and diaphragm assembly,

JF.15 - BRAKE FLUID RESERVOIR

Low Fluid Level Switch: The low fluid level switch may be removed from the reservoir without draining the fluid. Disconnect the harness plug, and squeeze the locking tabs on the end of the sensor opposite to the connector plug. Withdraw the sensor.

To refit the sensor, push into position until the tabs snap into place, and connect the harness plug.

Reservoir: Before removing the reservoir, thoroughly clean the reservoir and surrounding area to reduce the possibility of dirt ingress during or after removal.

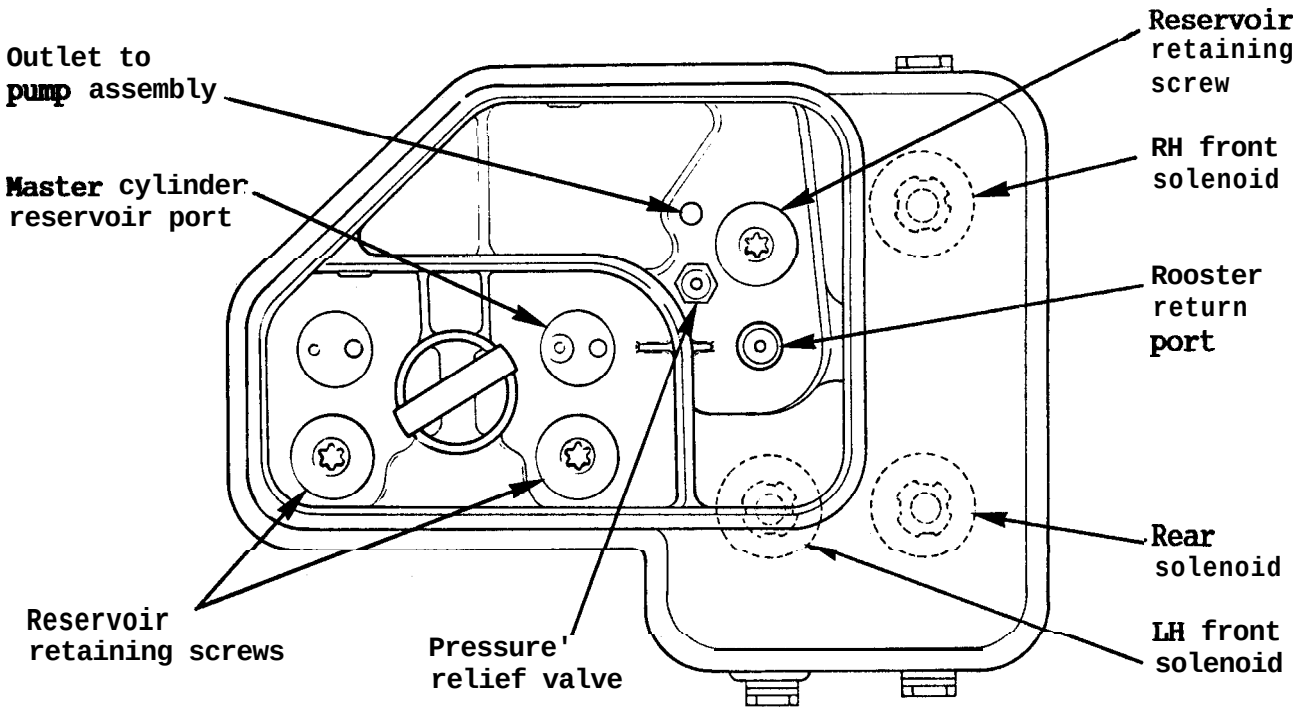
1. Depressurise the accumulator by turning off the ignition and FIRMLY applying the brake pedal 40 times. A noticeable change in pedal feel (to a hard pedal) will occur when the accumulator is completely discharged.

2. Release the reservoir cover, and use a syringe to remove as much fluid as possible from the reservoir, Discard fluid.

3. Protect the surrounding area of bodywork and electrical connections from fluid drips when the reservoir is removed. Unplug low fluid level switch.

4. Use a suitable container or shop towel to catch fluid, and disconnect from the reservoir the fluid supply hose from reservoir to pump assembly.

5. Use a Torx spline wrench to release the three screws inside the reservoir, securing the reservoir to the master cylinder assembly, and carefully lift the reservoir off the solenoids.



6. Before re-fitting the reservoir, thoroughly inspect the solenoid seals for damage, and correctly position the reservoir sealing gasket on the master cylinder assembly.

7. Carefully fit the reservoir over the solenoids, and fit the three securing screws. Torque tighten to 4 • 5 Nm (35 • 45 lbf.in).

8. Refit the low pressure hose to the reservoir, and connect the low fluid level switch.

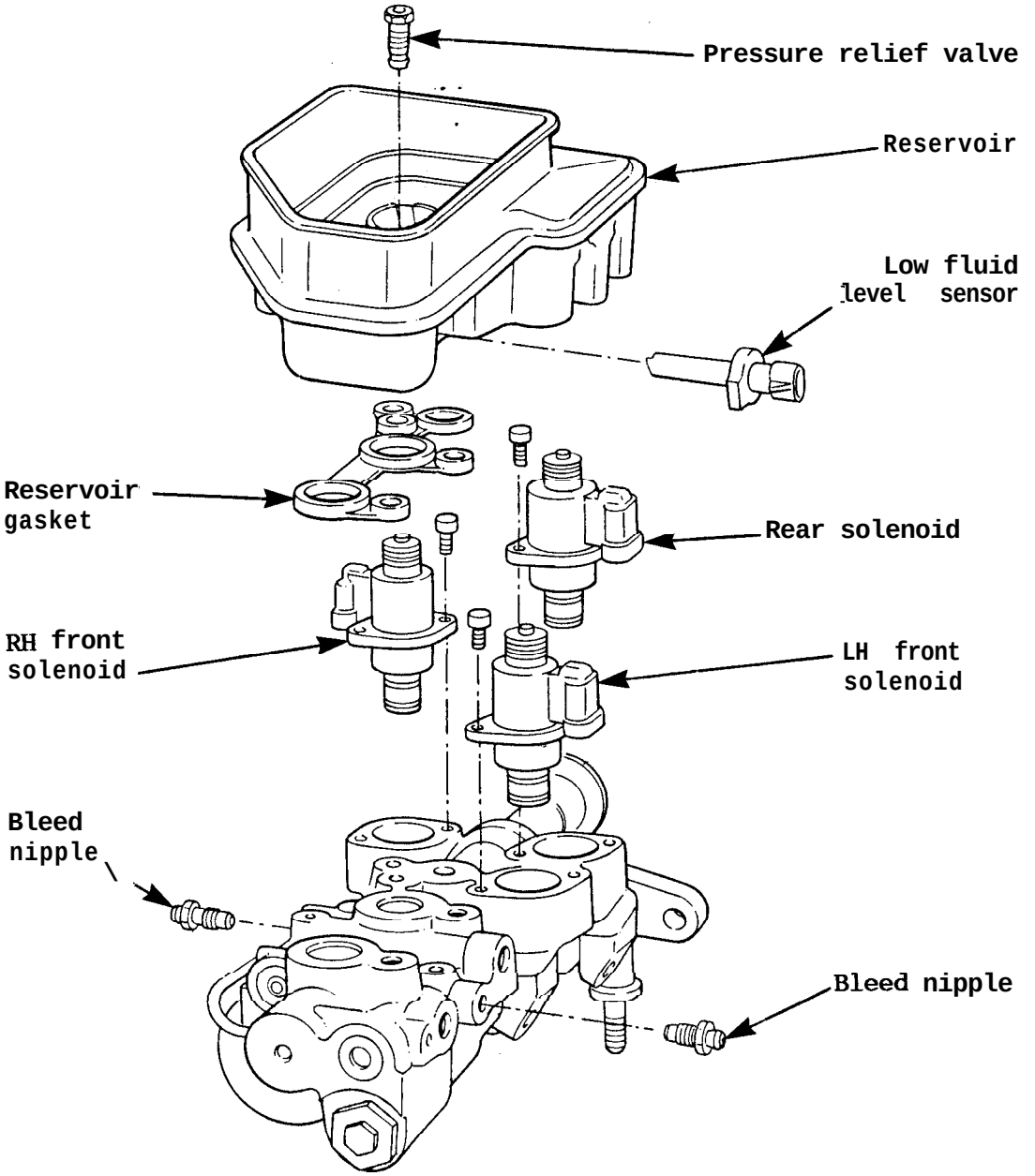
9. Refill the reservoir with new DOT 4 fluid and bleed the system as in JF.8.

JF.16 • SOLENOID VALVES

The solenoid valves, one for each front circuit and one for the combined rear circuit, may be removed from the master cylinder/booster assembly after removing the fluid reservoir.

1. Remove the brake fluid reservoir (see section JF.15).

2. Unplug the electrical connector from the solenoid, and use a Torx spline wrench to remove the two solenoid retaining screws. Withdraw the solenoid.



3. Before refitting the solenoid, check that both '0' rings on the lower end of the solenoid are in place and in good condition. Check the condition of the solenoid top seal, and replace any seal if in doubt.

4. Lubricate the '0' rings with clean DOT 4 fluid before inserting the solenoid into its bore in the master cylinder/booster assembly.

IMPORTANT: Ensure that the correct solenoid is fitted into the correct position - the two front solenoids (identical, with black connector sockets) are fitted in the right hand and left hand front positions, and the rear solenoid (tan or grey connector) is fitted in the left hand rear position.

5. Retain the solenoid with the two Torx screws, and tighten to 4 - 5 Nm (33 - 45 lbf.in).

6. Refit reservoir (see section JF.15) and bleed brake system (JF.8).

JF.17 • MASTER CYLINDER/BOOSTER ASSEMBLY

Servicing of the master cylinder/booster- assembly is limited to the fluid reservoir components, and the solenoid valves as previously described. .The master cylinder, displacement cylinders and isolation valves are not serviceable, and if found to be faulty, must be rectified by fitting a replacemnt master cylinder/booster assembly.

To Remove:

1. **Depressurise the accumulator** by turning off the ignition and FIRMLY applying the brake pedal up to 40 times. A noticeable change in pedal feel (to a hard pedal) will occur when the accumulator is completely discharged.

2. Release the reservoir cover, and use a syringe to remove as much fluid as possible from the reservoir. Discard fluid.

3. Protect the surrounding area of bodywork and any electrical equipment from fluid drips during the course of unit removal. Unplug the harness from the low fluid level switch and the three solenoids.

4. Use a suitable container or shop towel to catch fluid, and disconnect from the reservoir the fluid supply hose from reservoir to pump assembly.

5. Ensure that the accumulator has been fully depressurised before disconnecting the high pressure pipe from pump/accumulator to master cylinder/booster (M10thread).
   NOTE: After disconnecting any brake pipes, always plug both the pipe end and the port to prevent dirt ingress and reduce fluid spillage.

6. Disconnect the two front brake pipes (Ml2 and Ml3 thread) and the single rear brake pipe (Ml4 thread) from the master cylinder/booster.

7. From within the driver's footwell, remove the clevis pin connecting the brake pedal to the pushrod.

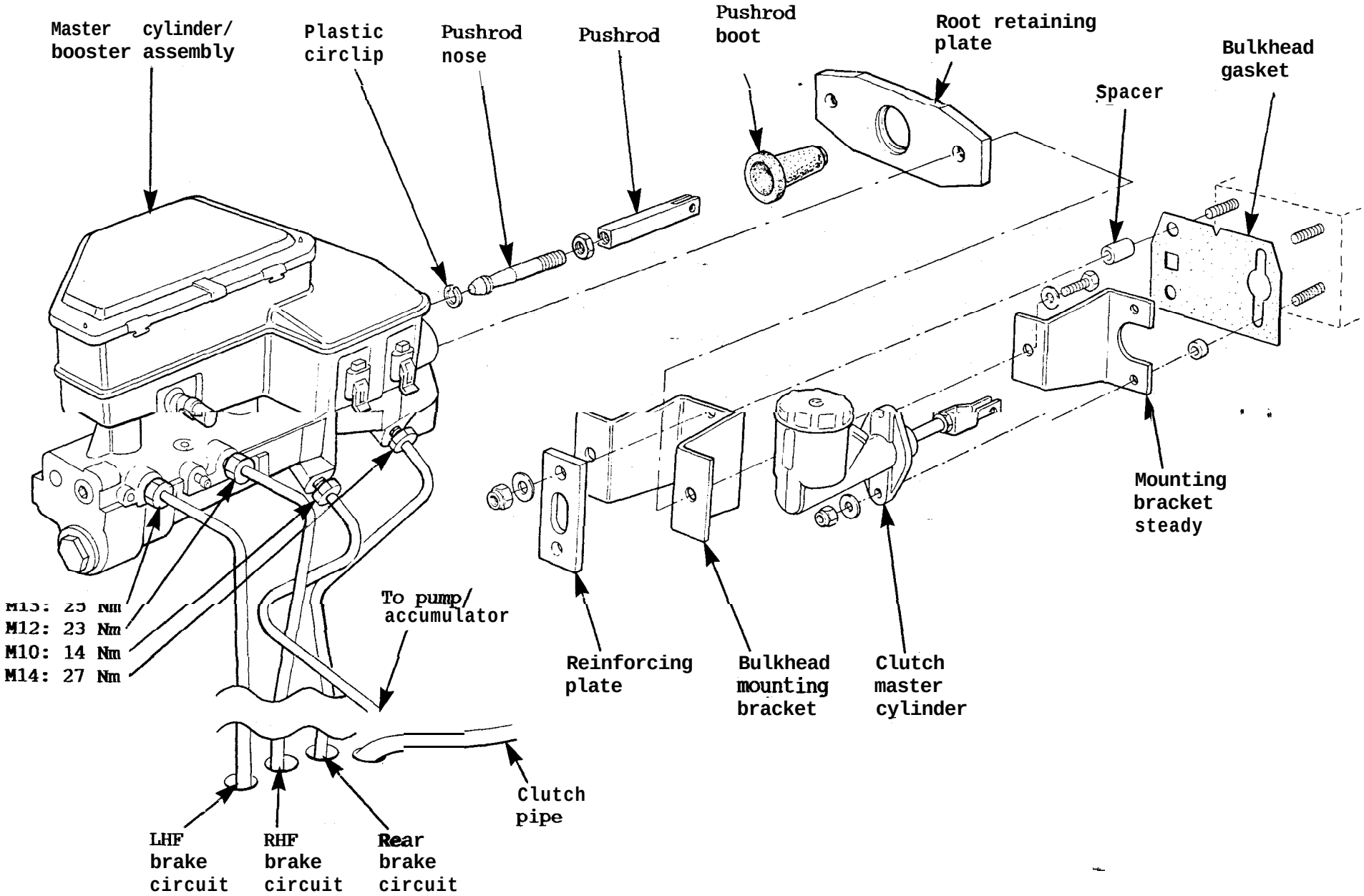
8. Remove the two bolts securing the unit to the bulkhead mounting bracket, and withdraw the master cylinder/booster assembly and pushrod from the car.

9. Slacken the pushrod locknut, and screw the pushrod off the pushrod nose. Remove the pushrod nose boot. If it is necessary to remove the pushrod nose from the unit (e.g. if fitting a replacement master cylinder/booster assembly), the plastic retaining clip will be damaged during removal and must be renewed. Order at the same time as the main unit.

To Refit:

1. If necessary, fit the pushrod nose into the master cylinder/booster assembly, and retain with a new plastic circlip. Fit the pushrod nose boot. Screw the locknut and pushrod onto the pushrod nose.

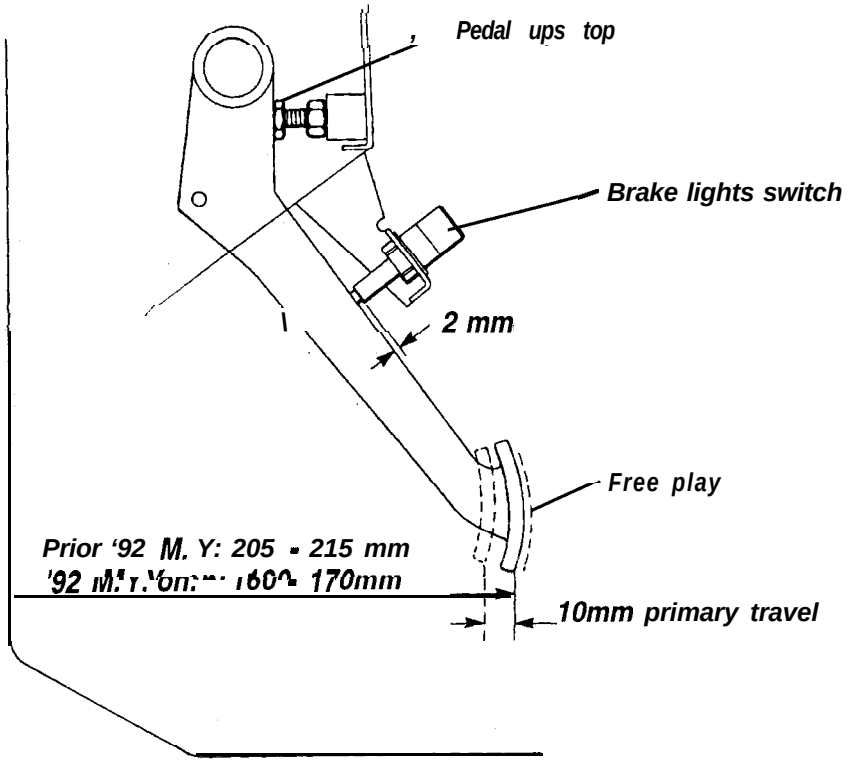
2. Fit the boot carrier plate over the pushrod and locate the boot and plate correctly against the master cylinder/booster assembly. Fit the master cylinder/booster assembly to the bulkhead mounting bracket, passing the pushrod through the bulkhead gasket. Secure the unit with the two 3/8" UNC bolts and flat washers with Permabond Al38 (A074B6009V) applied to the threads. Torque tighten to 33 Nm (25 Ibf.ft).


Master cylinder/ booster assembly
Plastic circlip
Pushrod nose
Pushrod
Pushrod boot
Root retaining plate
Spacer
Bulkhead gasket
Mounting bracket steady
M12: 23 Nm
M10: 14 Nm
M14: 27 Nm
To pump/ accumulator
Reinforcing plate
Bulkhead mounting bracket
Clutch master cylinder
Clutch pipe
LHF brake circuit
RHF brake circuit
Rear brake circuit

3. Before adjusting the brake pedal pushrod length, first remove the stop light switch (twist ¼ turn counterclockwise) and adjust the brake pedal height. Measure horizontally from the steel pedal pad to the bulkhead. as shown in the diagram, and adjust the pedal upstop to achieve the specified dimension:

   cars prior to '92 M.Y.: 205 - 215 mm
   cars '92 M.Y. onwards: 160 - 170 mm

   Check that the brake pedal pivots freely and does not stick or bind.



4. Adjust the effective length of the pushrod by screwing the pushrod nose in or out of the pushrod until the clevis pin can be fitted freely without preloading the pushrod - the pedal should 'rattle' with a few millimetres of free play. Check that the pedal travels about 10 mm before a noticable increase in resistance.

5. Fit the brake light switch into its mounting bracket, and set so that when twisted ¼ turn clockwise to retain, there is about 2 mm of the white plunger visible. The brake lights should come on after about 7 mm of pedal movement. Note that the ABS requires a signal from the stop switch as an indication of brake application before the system will operate.

6. Fit the two front brake pipes (Ml2 & Ml3 thread) and the single rear brake pipe (Ml4 thread) to the master cylinder/booster assembly. Tighten all unions:

   Ml2 - 23 Nm (17 lbf.ft)
   Ml3 - 25 Nm (18 lbf.ft)
   Ml4 - 27 Nm (20 lbf.ft)

7. Fit the high pressure supply pipe (Ml0 thread) from the accumulator to the master cylinder/booster, and torque tighten to 14 Nm (10 lbf.ft).

8. Fit the pump supply hose to the reservoir and tighten the hose clip.

9. Reconnect the harness to the low fluid level switch, and to the three solenoids.

10. Fill the reservoir with DOT 4 fluid and bleed the brake system (see section JF.8).

JF.18 ▪ PUMP/ACCUMULATOR ASSEMBLY

The pump/accumulator assembly is located at the right hand side of the front luggage compartment. The pump is suspended from its mounting bracket on three bonded rubber bushes in order to provide some noise isolation. The accumulator is screwed into an alloy 'end plate' which connects with the pump, houses the (non serviceable) non return valve, and provides take off points for the pressure switch and high pressure pipe to the master cylinder/booster assembly.

To Replace Pressure Switch

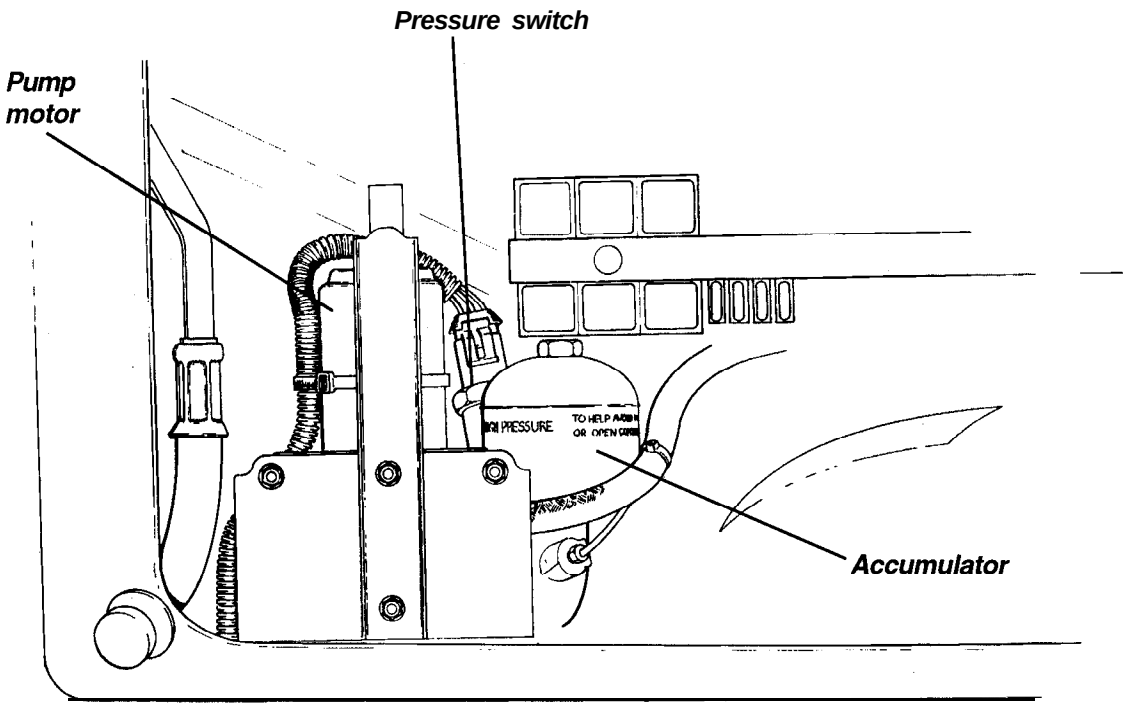
The pressure switch fitted in the endplate of the accumulator, controls the system hydraulic pressure and the running of the electric pump. The switch was recalibrated during 1993 to reduce seal friction in the booster/master cylinder assembly, with the new switch identified by a grey (previously black) plastic body. All cars should be updated to the new type switch.

1. **Depressurise the accumulator** by turning off the ignition and FIRMLY applying the brake pedal up to 40 times. A noticeable change in pedal feel (to a hard pedal) will occur when the accumulator is completely discharged.

2. Before unscrewing the pressure switch from the pump/accumulator endplate, have the new switch ready and prepared for fitment to avoid the necessity to bleed the hydraulic system:
   Lubricate the '0' ring supplied with the new pressure switch using DOT 4 brake fluid and fit the ring onto the new switch.

3. On LHD cars, it may be necessary to release the relay bracket fixings for sufficient access to the pressure switch in the pump/accumulator endplate.
   Disconnect and unscrew the pressure switch from the endplate extension beneath the accumulator using a long reach 39 mm (1½ in) socket - available under T000T1238F. Use a shop towel to absorb any escaping fluid.

4. Screw the new switch and '0' ring into the endplate and torque tighten to 20 - 27 Nm (15 - 20 lbf.ft). Connect the harness plug to the switch.



J36

To Replace Accumulator

NOTE: The accumulator is a nitrogen-charged pressure vessel which holds brake fluid under high pressure. No re-charging or other repairs can be made. If the pre-charge is diagnosed as being low (section JF.14) the unit must be replaced.

1. **Depressurise the accumulator** by turning off the ignition and FIRMLY applying the brake pedal 40 times. A noticeable change in pedal feel (to a hard pedal) will occur when the accumulator is completely discharged.

2. Unscrew the accumulator from the endplate using a 17 mm socket.

3. Fit a new '0' ring on the accumulator spigot and lubricate with DOT 4 fluid. Screw the accumulator into the endplate and tighten to 31 ▪ 35 Nm (23 ▪ 26 lbf.ft).

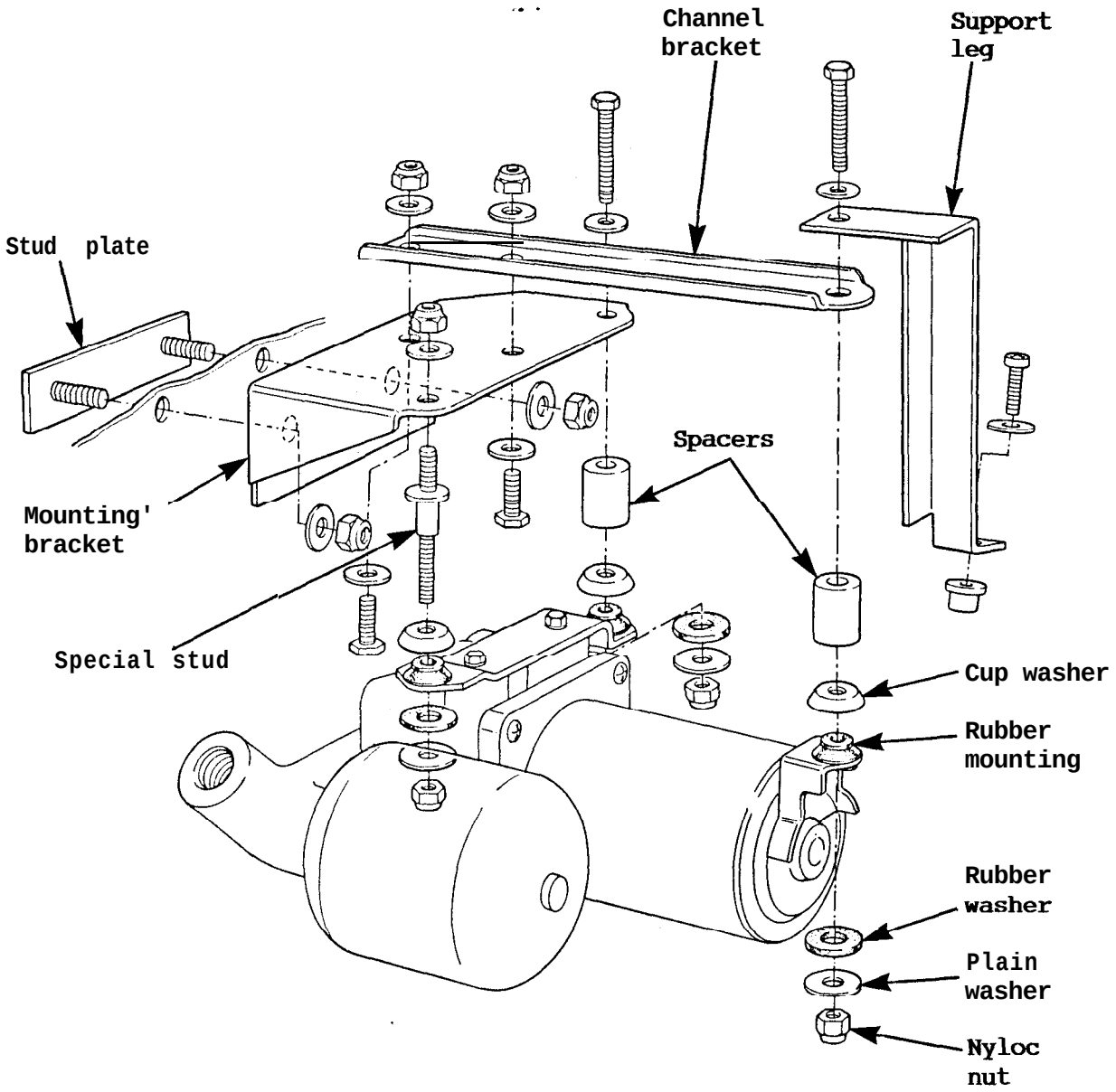
4. Bleed the brake system as in JF.8.

To Replace Pump/Accumulator Assembly

1. **Depressurise the accumulator** by turning off the ignition and FIRMLY applying the brake pedal 40 times. A noticeable change in pedal feel (to a hard pedal) will occur when the accumulator is completely discharged.

2. Disconnect the harness from the pump motor and pressure switch.

3. Use a shop towel to absorb brake fluid, and disconnect the fluid supply hose from the pump. Remove the high pressure bundy pipe from the pump end plate and master cylinder/booster.



4. Remove the three pump assembly fixings (M5/M6). Remove the mounting bracket support leg, and on RHD cars, the top channel to allow the pump/accumulator assembly to be withdrawn.

5. When replacing the pump/accumulator assembly, ensure that the assembly sequence at each mounting point is correctly maintained, with the washers, rubber washers, spacers and cup washers positioned as shown in the illustration.

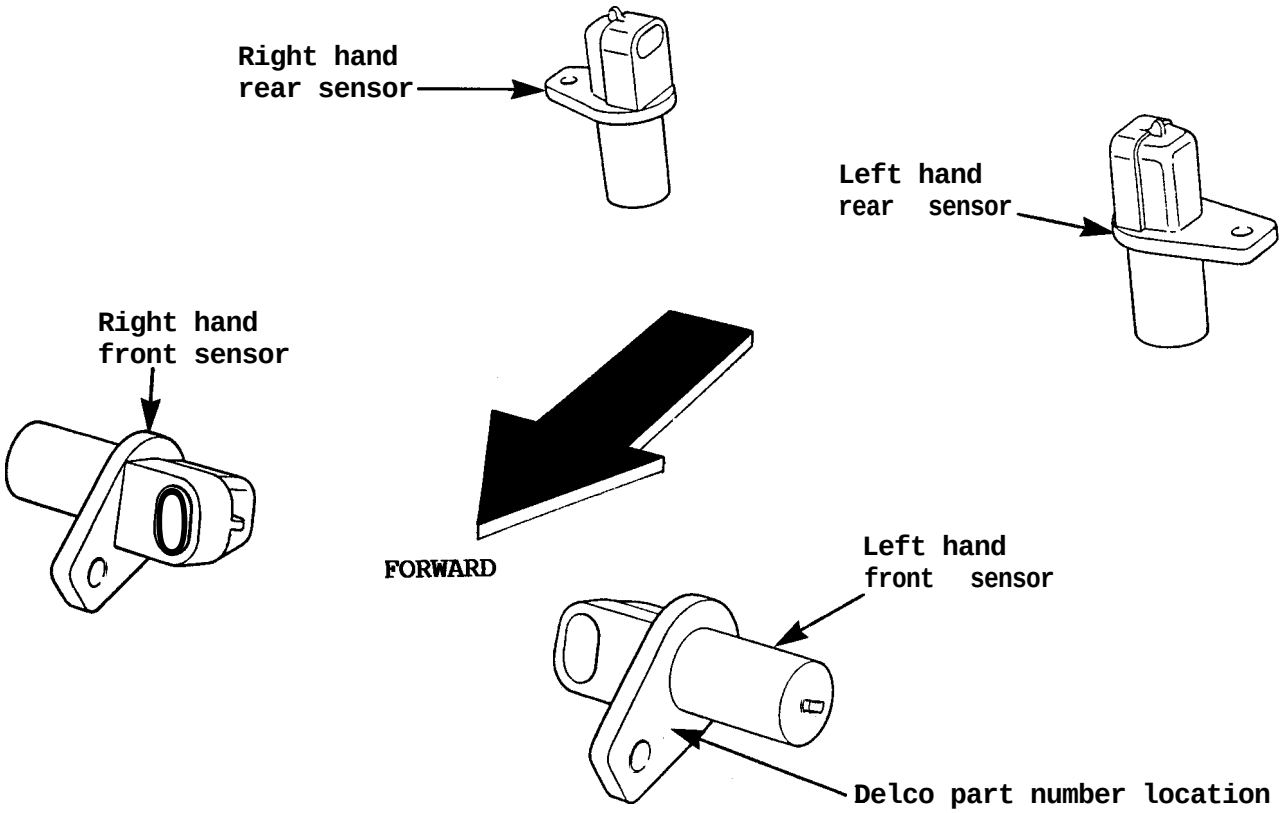
6. Connect the low pressure fluid supply hose, and the high pressure bundy pipe. Tighten the bundy pipe tube nuts to 13 - 20 Nm (10 - 15 lbf.ft).

7. Plug in the pump and pressure switch electrical connectors.

8. Bleed the brake system as detailed in section JF.8.

JF.19 - WHEEL SPEED SENSORS

Three variations of the wheel speed sensor are used in the anti-lock brake system. On the front sensors, the mounting hole is offset in relation to the pole piece and electrical connector axis, at an angle of 45° in opposite directions for the left and right hand side. The mounting hole on both rear sensors is in line with the pole piece. Note that the right hand rear hub carrier on fuel injected cars is also fitted with a separate vehicle speed sensor which may be identified by its staight electrical connector. It is most important not to fit a sensor in the wrong position, or incorrectly connect the harness.



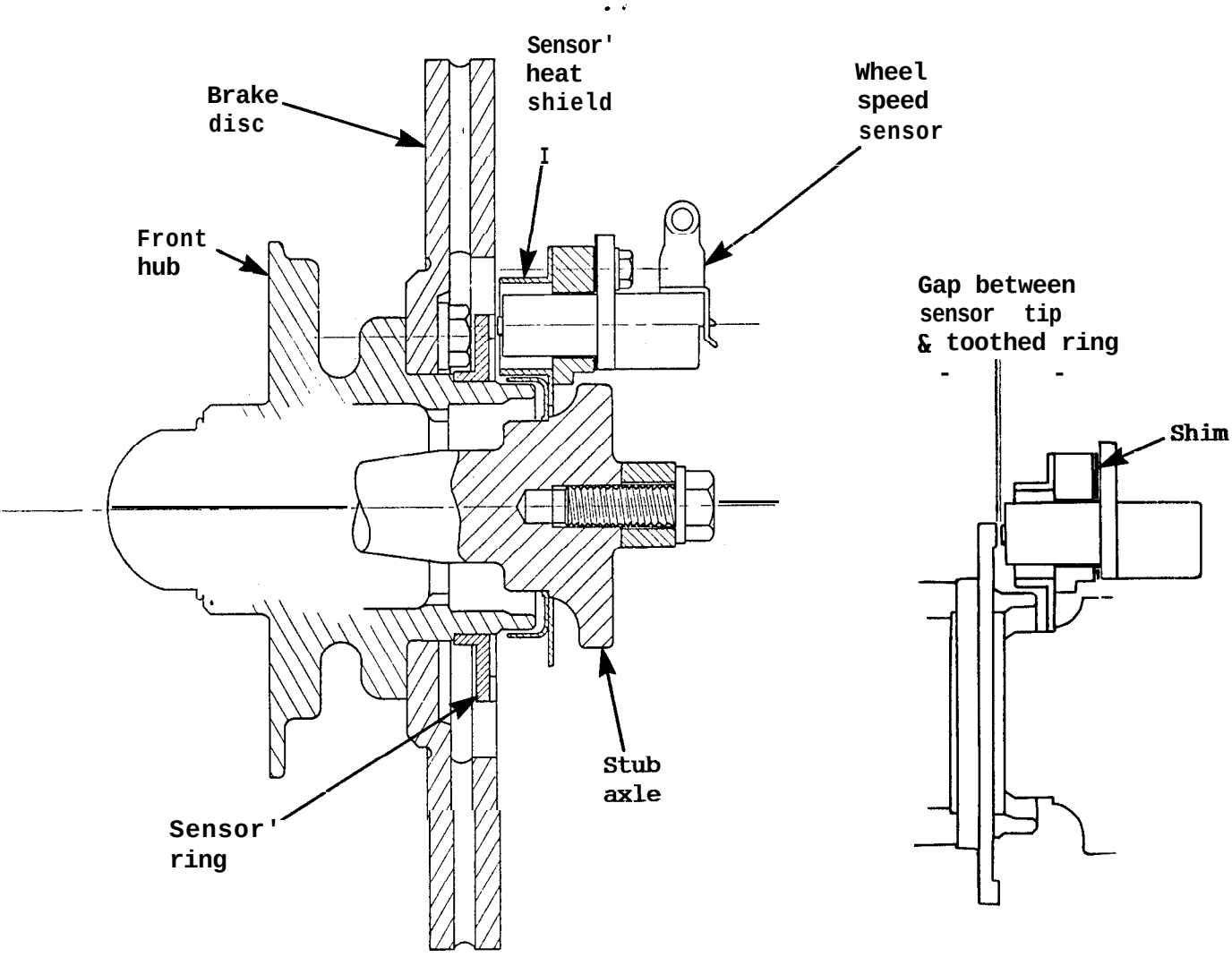
For identification of the sensors, refer to the diagram and to the Delco part number moulded on the underside of the mounting flange:

Right hand front sensor:	10456052
Left hand front sensor:	10456053
Rear sensor (RH & LH):	10456051 or 10456099 or 10456151

Front Wheel Speed Sensors

The front wheel speed sensors are secured to the brake disc shields, themselves bolted to the front suspension uprights. The gap between the sensor tip and the pole wheel is critical, and must be adjusted if necessary using shims. Before checking the gap, ensure that the taper roller front wheel bearings are correctly adjusted - see Service Notes section CD.5 or CF.4.

Gap between sensor tip and pole wheel = 0.6 - 1.4 mm (0.024 - **0.055** in).



To adjust the gap, release the single screw securing the sensor, and if applicable, the remaining screw securing the shim pack to the disc shield. Shims are available in thicknesses of 0.75 mm (0.030 in), 0.95 mm (0.037 in), and 1.25 mm (0.050 in). Add or delete shims as necessary to achieve specification, and secure the shims with the M6 setscrew. Fit the sensor into position and tighten its M6 setscrew to 9 Nm (6.5 lbf.ft). Recheck gap.

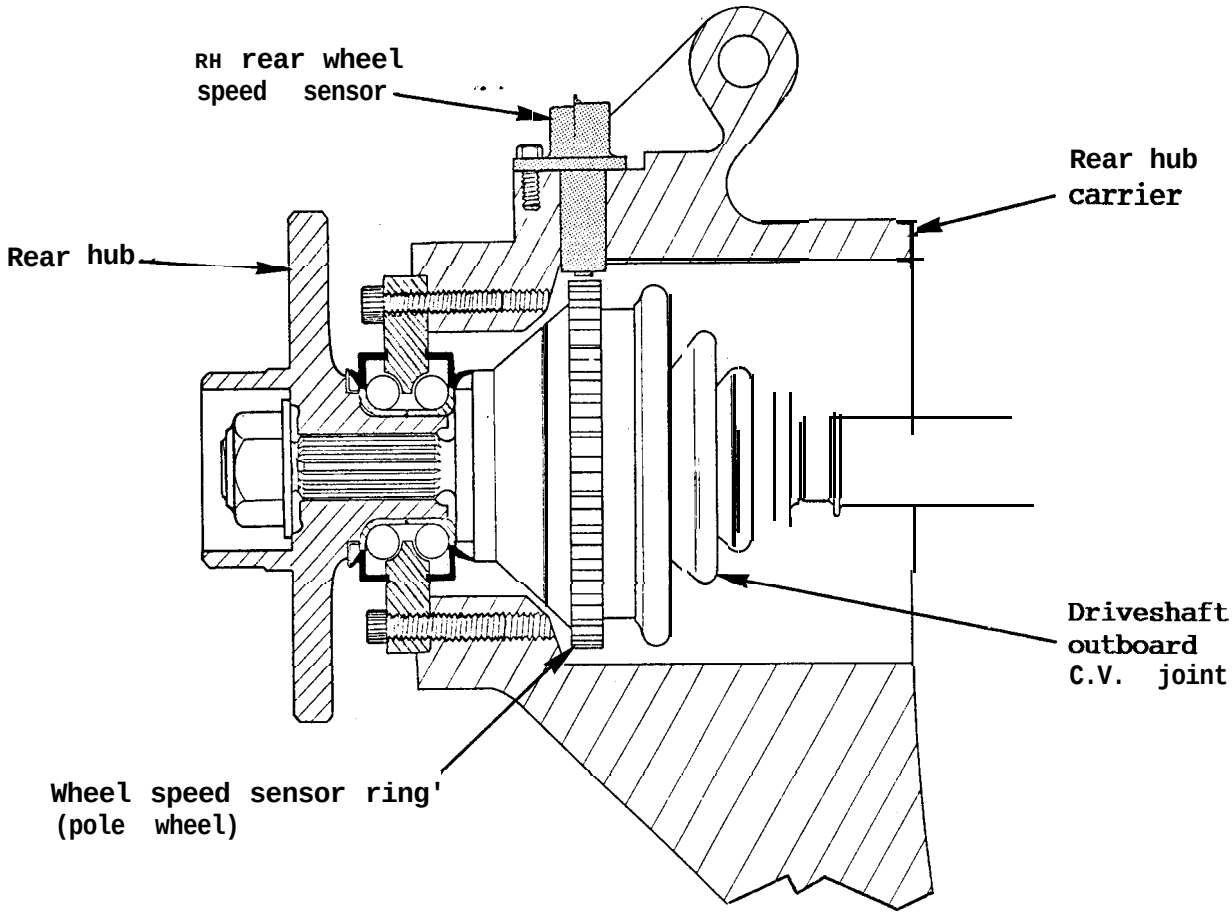
The pole wheel is pressed onto the hub, and must be removed if the brake disc is to be replaced. See section JF.11.

Rear Wheel Speed Sensors

The rear wheel speed sensors are mounted in the cast alloy rear suspension uprights, with the pole wheels pressed onto the outboard driveshaft C.V. joints.

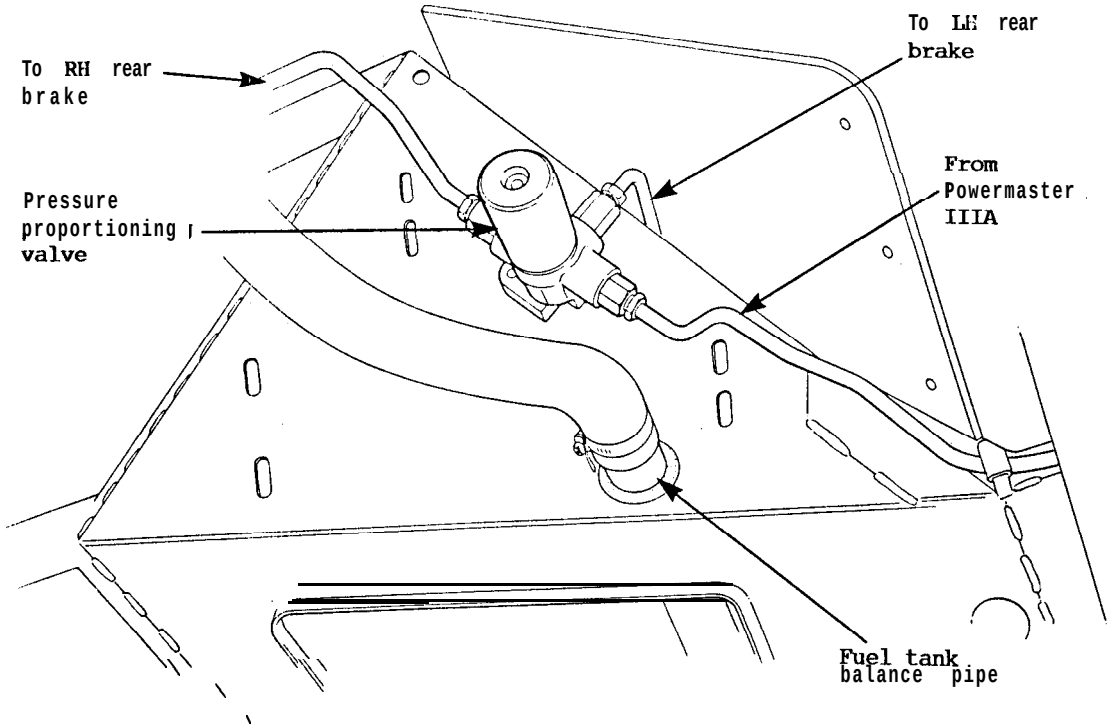
The gap between sensor tip and pole wheel should be 0.6 - 1.4 mm (0.024 - 0.055 in). There is no provision for adjustment, and if the gap is found to be outside specification, check for an incorrectly seated sensor, displaced pole wheel or faulty wheel bearings.

Note that on fuel injected cars, the right hand rear hub carrier also houses a vehicle speed sensor for the engine management system. The electrical connector on this sensor, has a vertical axis.



JF.20 • PROPORTIONING VALVE

The proportioning valve is fitted into the rear brake circuit at the right hand front of the engine bay, and under normal circumstances has no effect on the standard or anti-lock braking system. The purpose of the valve is to prevent over adjustment of the rear caliper parking brake mechanism if abnormally high



pressures are produced in the rear brake line, such as may occur if the pedal is vigourously pressed with the vehicle stationary (when the ABS does not operate to control pressures). The valve also serves to divide the supply into separate right and left hand circuits.

To replace the valve, use a 17 mm wrench to prevent the adaptors from turning whilst the brake pipe sleeve nuts are released. Use a shop towel to absorb any escaping fluid, and cap the pipe ends and valve ports immediately after disconnection. Release the valve fixing screw and remove the valve.

JF.21 - ABS CONTROLLER, RELAYS & FUSES

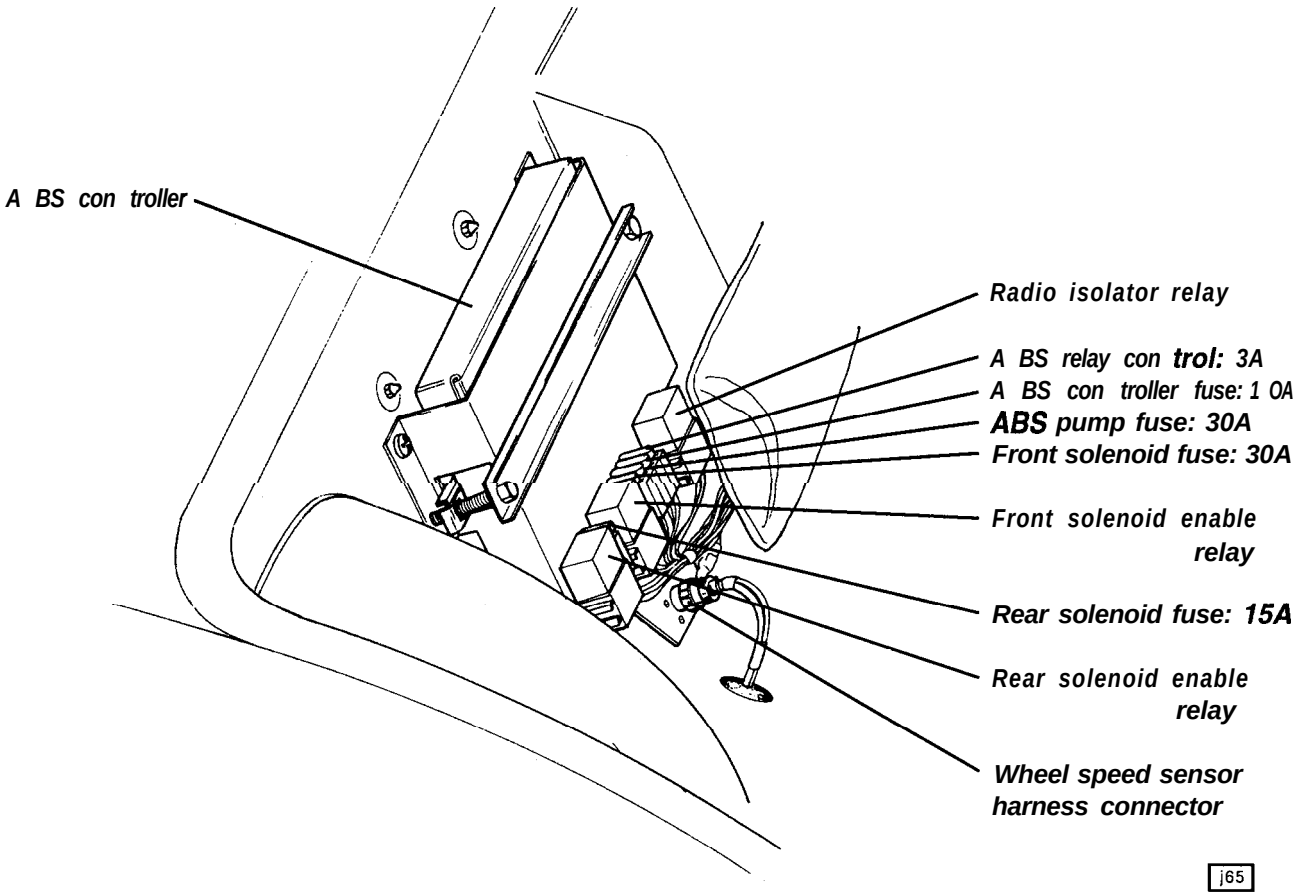
The ABS controller, or electronic control unit (ECM), is mounted on the passenger side front bulkhead in the front luggage compartment. The mounting bracket uses a clamping channel to secure the ECM to the bracket, and also carries a row of relays and fuses, and on pre 'revised harness' cars, the wheel speed sensor harness connector socket.

The relays are:
- radio isolator (only on pre 'revised harness' cars);
- front solenoid enable;
- rear solenoid enable.

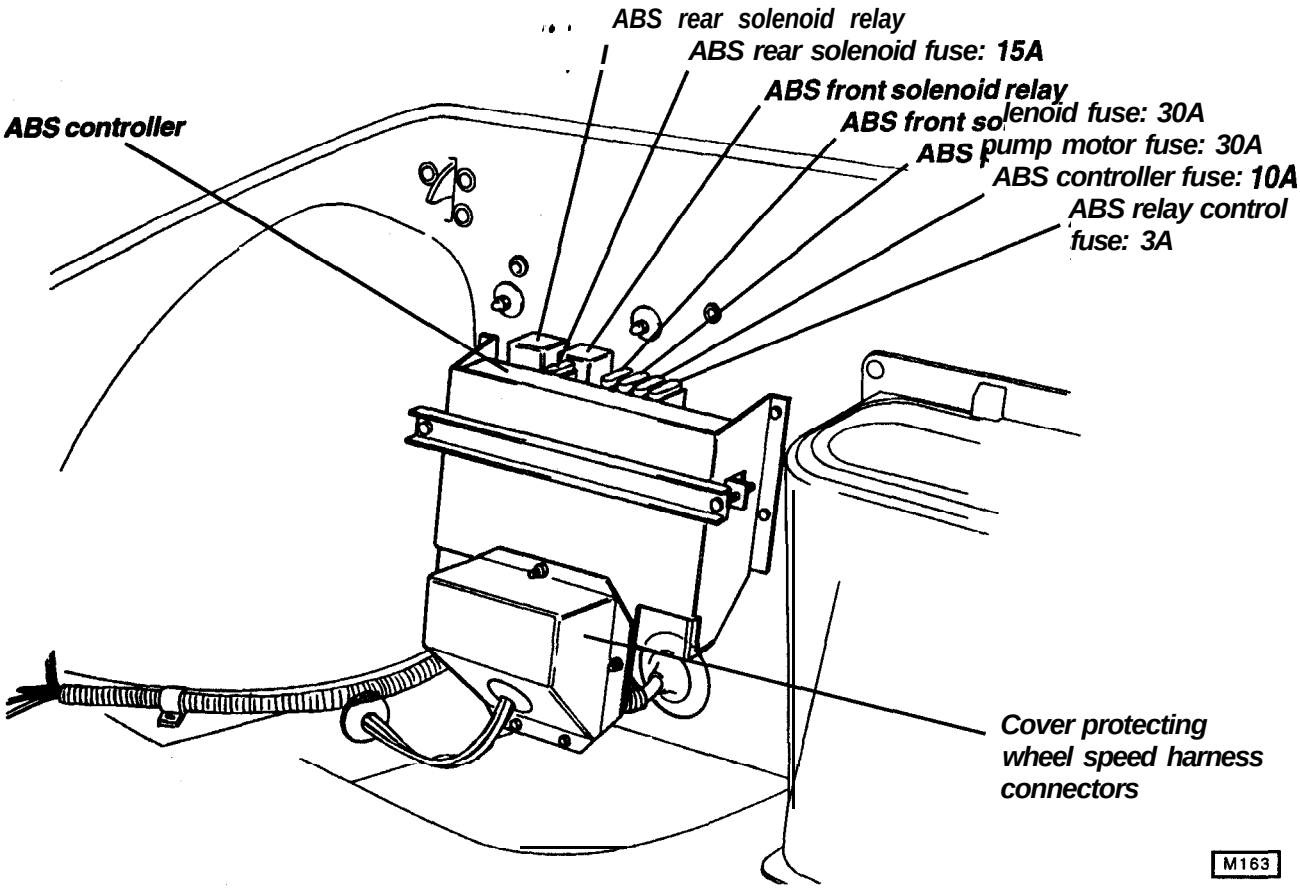
The fuses are:
- ABS relay control (3A)
- ABS controller fuse (10A)
- ABS pump fuse (30A)
- front solenoid fuse (30A)
- rear solenoid fuse (15A)

To remove the ABS controller, slacken the two clamping bolts, and slide the controller out of the bracket sufficiently to disconnect the electrical plug.

Early Cars: Passenger side front bulkhead

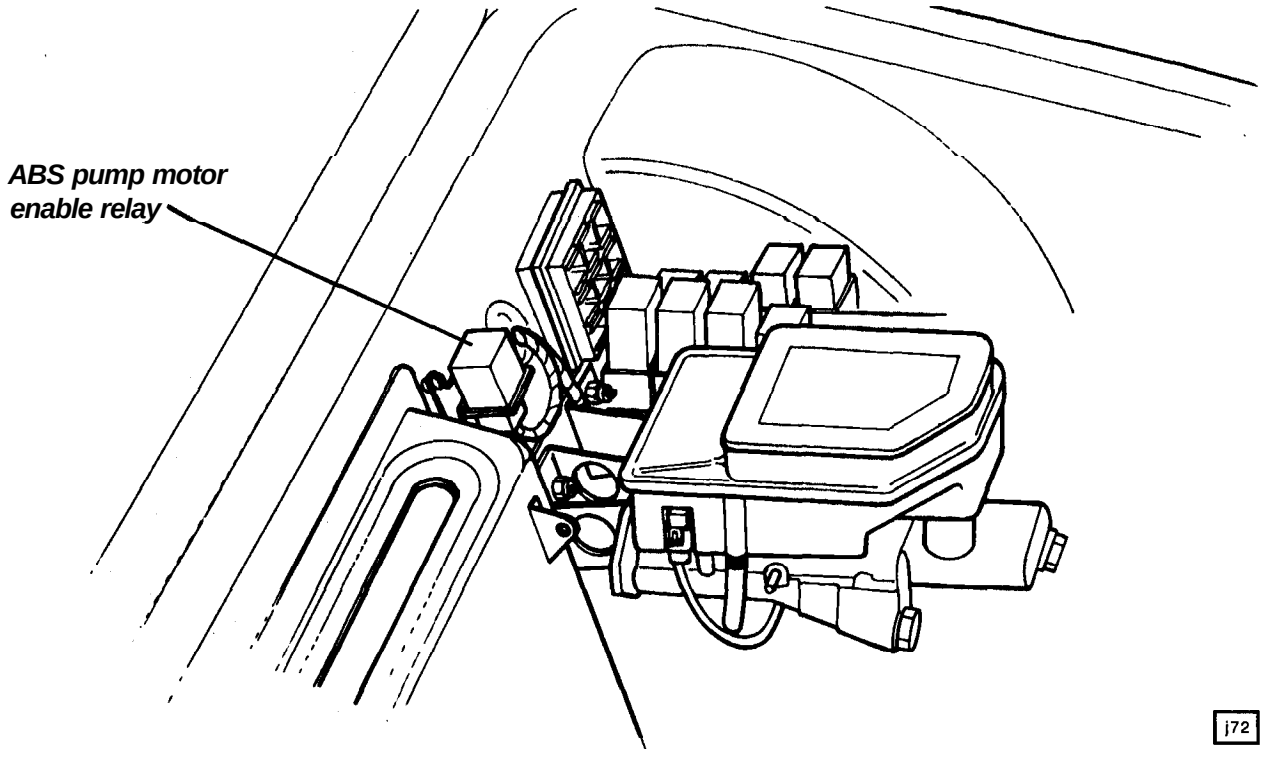

A BS con troller
Radio isolator relay
A BS relay con trol: 3A
A BS con troller fuse: 1 OA
ABS pump fuse: 30A
Front solenoid fuse: 30A
Front solenoid enable relay
Rear solenoid fuse: 15A
Rear solenoid enable relay
Wheel speed sensor harness connector
j65

'Revised Harness' Cars: Passenger side front bulkhead


ABS rear solenoid relay
ABS rear solenoid fuse: 15A
ABS front solenoid relay
ABS front solenoid fuse: 30A
ABS pump motor fuse: 30A
ABS controller fuse: 10A
ABS relay control fuse: 3A
ABS controller
Cover protecting wheel speed harness connectors
M163

The ABS pump motor enable relay is fitted on the driver's side of the front bulkhead, adjacent to the main vehicle fusebox.

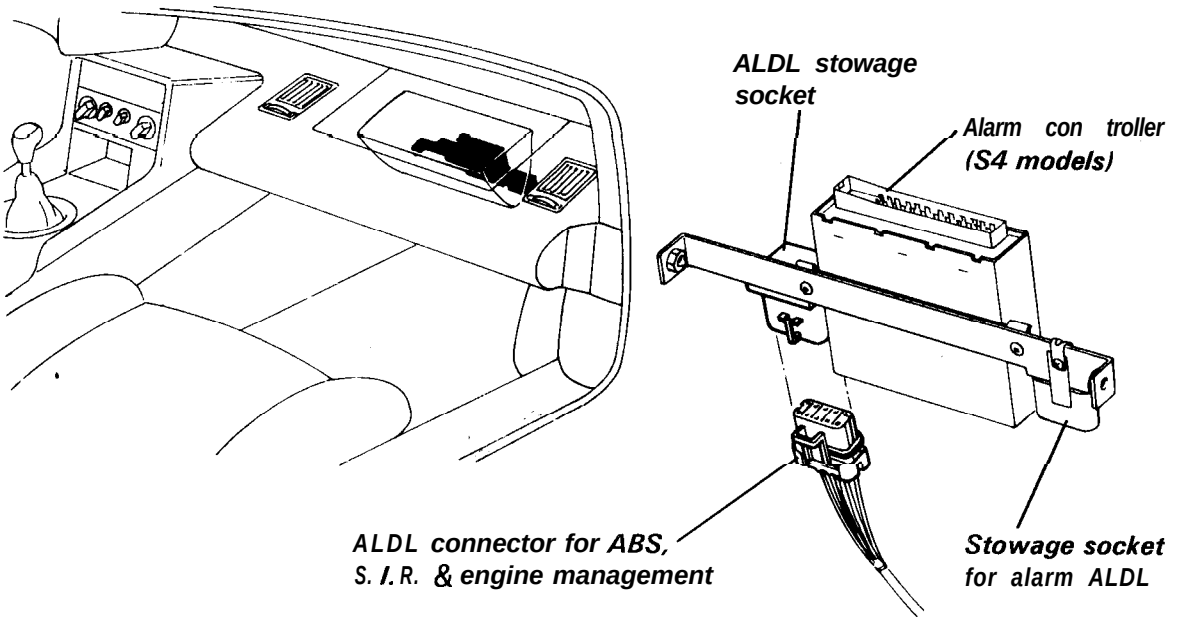
LHD shown (RHD sym. opposite)



Note that the lamp driver module (operates the ABS tell tale lamp) is taped to the fascia harness near to the wiper motor.

ALDL Connector

The Assembly Line Diagnostic Link (ALDL) connector is a ten way electrical connector plug which provides a means of communication between the ABS controller and electronic test/diagnostic equipment such as a 'Tech 1' scanner tool. The connector plug is attached to the fascia harness and is secured when not in use in a stowage socket on the inboard side of the back of the glovebox, or on S4 models to the alarm controller mounting bracket in the same area. This connector is also used for engine management diagnosis, and on cars so equipped, for S.I.R. (Supplementary Inflatable Restraint) diagnosis.


ALDL stowage socket
Alarm con troller (S4 models)
ALDL connector for ABS, S. I. R. & engine management
Stowage socket for alarm ALDL

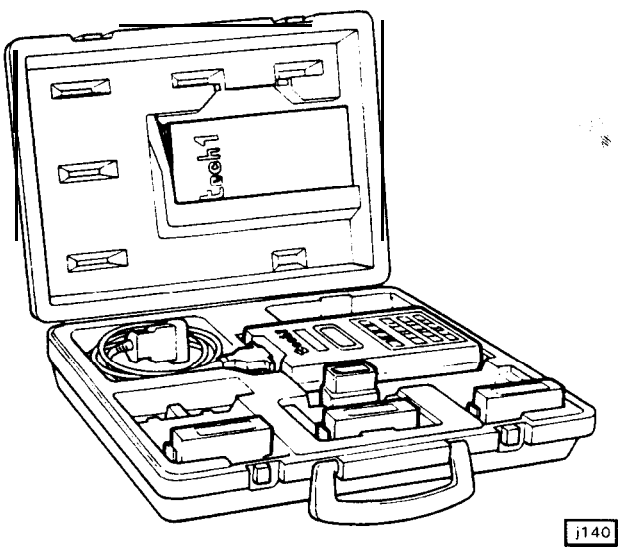
W44

Note that on Esprit S4 models, a similar connector is located at the outboard end of the glovebox, and is used solely for diagnosis of the vehicle alarm system.

JF.22 - SPECIAL TOOLS

'Tech 1' Diagnostic Scanner Kit TOOOT0896

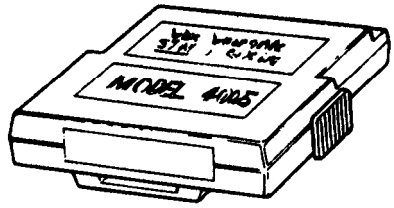
Plugs into ALDL connector and displays stored trouble codes and sensor readings. Kit includes scanner, connector lead, self-test adaptor, operator's manual and carrying case. Cartridge must be ordered separately.



j140

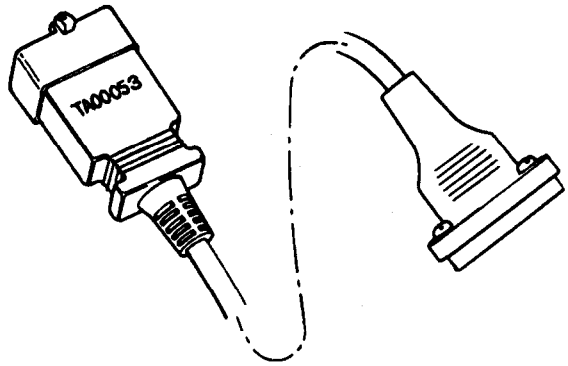
ARS **Cartridge.** 'Tech 1' scanner **T000T1115/1**

Plugs into Tech 1 scanner and contains data. . for Esprit ABS diagnostics.
Identified by 'LOTUS 1991 BRAKE' and 'Part Number **TK02380'** printed on the label.



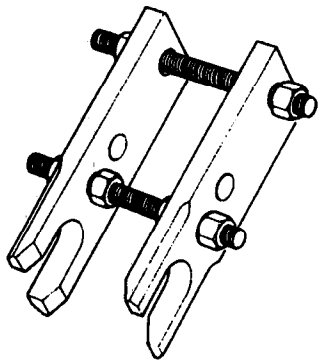
Connector Lead. **'Tech 1'** scanner **T000T0897/2**

Included in 'Tech 1' kit TOOOT0898.
Connects Tech 1 to ALDL socket.
The **/2** lead, which is also compatible with Elan models, is identified by 'TA00053' embossed in gold lettering on the ALDL end connector.



Rear Caliper Spreader T000T0556

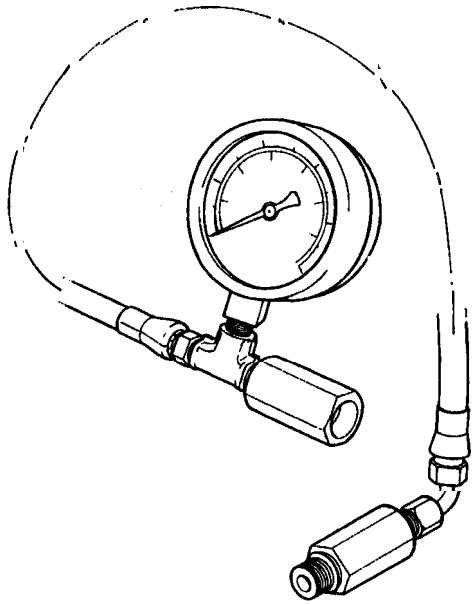
Used to spread wings of carrier bracket when replacing rear caliper cylinder.



j140

Pressure **Gauge T000T1** 112

Used in hydraulic diagnosis to test pump and accumulator and check for internal leakage in master cylinder/booster assembly.



j86

Section JF.25
DM- ABS IIIA
ANTILOCK BRAKE SYSTEM

Some operations in this section require that the hydraulic lines, hoses and Fittings be disconnected for inspection of testing purposes. This brake System uses a hydraulic accumulator which, when fully charged, contains Brake fluid at high pressure. Before disconnecting any hydraulic lines, hose or fittings, be sure that the accumulator is fully depressurized. Failure to depressurize the hydraulic accumulator may result in personal injury.

INTRODUCTION …… PAGE

Component Locations …….. 4
System Operation ……. 6
Circuit Operation …….. 6
ABS Controller ……. 6
Front Enable Relay ……... 6
Rear Enable Relay …… 7
Front and rear Solenoids ……... 7
Wheel Speed Sensor ……. 7
Brake Switch ……. 7
Pump Motor Circuit …….. 7
ABS Tell Tail …… 7
Lamp Driver Module ……. 7
Self Diagnostic Capabilities …….. 7
Diagnosis ……... 8
Pre-Diagnosis Inspection ……... 8
Trouble Codes …… 8
Additional Diagnostic Capabilities …… 8
ABS Snapshot …… 8
Manual Relay and Solenoid Control …….. 8
Enhanced Diagnostics …… 9
Note On Intermittents …… 10
Antilock Brake System Service Precautions ……. 10
Antilock Brake System Diagnostics Cannot Be Entered …….. 10
Figure 1. Pre-Diagnosis Inspection …… 11
Figure 2. Tech I ABS **Data** List ……. 12
Figure 3. Electric Schematic Diagram ……... 14
Antilock Brake System Diagnostics Cannot Be Entered …….. 16

TROUBLE CODE DIAGNOSIS

PAGE

CODE A001
ABS Tell Tale open or shorted to ground 18
CODE A002
ABS Tell Tale shorted to battery or Diode shorted 20
CODEA003
Diode open or ground open 22
CODE A004
Enable Relay or Solenoid fault detected 24
CODEA005
Front Enable Relay coil open, Contacts open, Fuse open 26
CODE A006
Front Enable Relay Coil shorted to battery 28
CODE A007
Rear Enable Relay coil open, Ccntacts open, Fuse open 30
CODE A008
Rear Enable Relay coil shorted to battery 32
CODE A009
Right Front Hold Solenoid open or shorted to ground 34
CODE A010
Left Front Hold Solenoid open or shorted to ground 36
CODE A01 1
Rear Hold Solenoid open or shorted to around 38
CODE-A012
Right Front Release Solenoid open or shorted to ground 40
CODE A013
Left Front Release Solenoid open or shorted to ground 42
CODE A014
Rear Release Solenoid open or shorted to ground 44
CODE A015
One or more front solenoids shorted 46
CODE A016
One or both rear solenoids shorted 48
CODE A017
Right Front Hold Solenoid shorted 50
CODE A018
Left Front Hold Solenoid shorted 52
CODE A019
Rear Hold Solenoid shorted 54
CODE A020
Right Front Release Solenoid shorted 56
CODE A021
Left Front Release Solenoid shorted 58
CODE A022
Rear Release Solenoid shorted . . . .*.. 60
CODE A023
Right Front Release Solenoid energized too long . . . .*..... 62
CODE A024
Left Front Release Solenoid energized too long 64
CODE A025
Rear Release Solenoid energized too long 66
CODE A026
Right Front Hold Solenoid energized too long . . . .*..... 68
CODE A027
Left Front Hold Solenoid energized too long 70
CODE A028
Rear Hold Solenoid energized too long 72
CODE A029
Brake Switch Fuse Input Circut Open 74
CODE A030
Both front, or one front and one rear wheel speed sensor open 76
CODE A031
Open Pump Motor feedback circuit 77
CODE A032
Open Brake Switch or Hydraulic leak 80

Section JF

Trouble Code Diagnosis

Page one of two

To Page Two

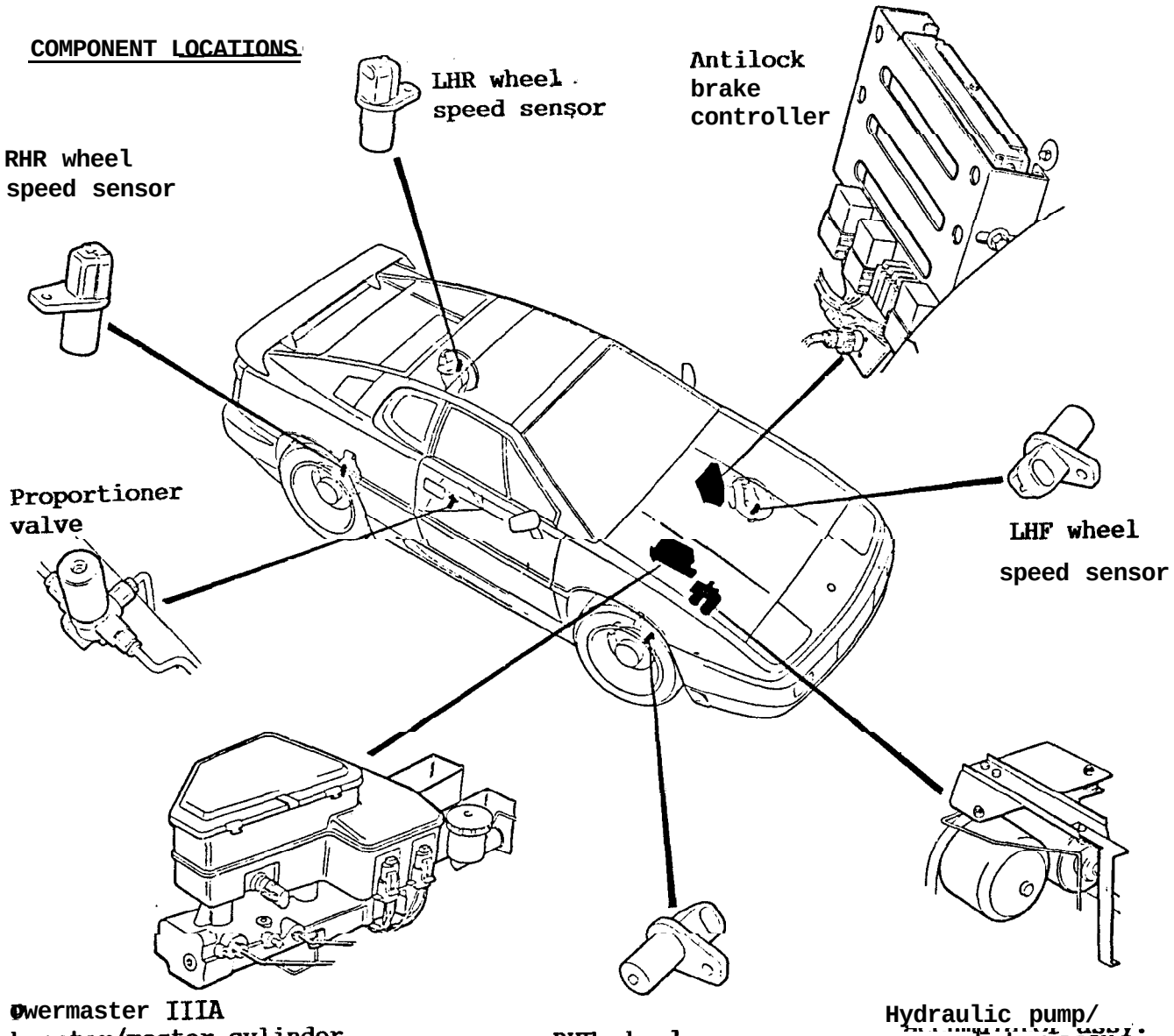
CODE		Page
A001	ABS Tell Tale open or shorted to ground	18
A002	ABS tale shorted to battery or Diode shorted	20
A003	Diode open or ground open	22
A004	Enable Relay or Solenoid fault detected	24
A005	Front Enable Relay coil open, Contacts open, Fuse open	26
A006	Front Enable Relay Coil shorted to battery	28
A007	Rear Enable Relay Coil open, Contacts open, Fuse open	30
A008	Rear Enable Relay coil shorted to battery	32
A009	Right Front Hold Solenoid open or shorted to ground	34
A010	Left Front Hold Solenoid open or shorted to ground	36
A011	Rear Hold Solenoid open or shorted to ground	38
A012	Right Front Release Solenoid open or shorted to ground	40
A013	Left Front Release Solenoid open or shorted to ground	42
A014	Rear Release Solenoid open or shorted to ground	44
A015	One or more front solenoids shorted	46
A016	One or both rear solenoids shorted	48
A017	Right Front Hold Solenoids shorted	50
A018	Left Front Hold Solenoids shorted	52
A019	Rear Hold Solenoid shorted	54
A020	Right Front Release Solenoid shorted	56
A021	Left Front Release Solenoid shorted	58
A022	Rear Release Solenoid shorted	60
A023	Right Front Release Solenoid energized too long	62
A024	Left Front Release Solenoid energized to long	64
A025	Rear Release Solenoid energized to long	66
A026	Right Front Hold Solenoid energized long	68
A027	Left Front Hold Solenoid energized to long	70
A028	Rear Hold Solenoid energized to long	72
A029	Brake Switch Fuse Input Circuit Open	74
A030	Both front or one front and rear wheel speed sensor open	76
A031	Open Pump Motor feedback circuit	77
A032	Open Brake Switch or Hydraulic leak	80

Section JF

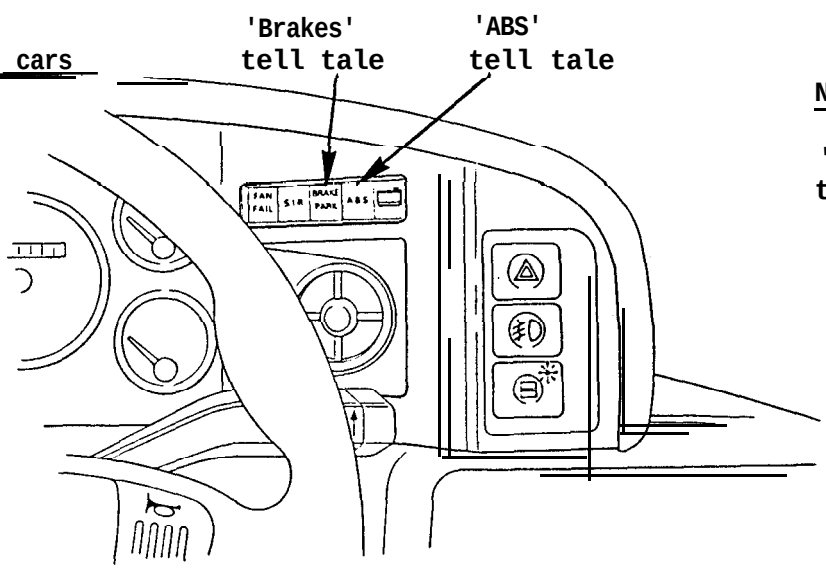
Trouble Code Diagnosis

CODE		Page
A033	Brake switch Open	82
A034	Brake Switch Shorted	84
A035	Pump Motor running to long	86
A036	Pump Motor will not run	88
A037	Front Enable Relay Coil shorted to ground	90
A038	Rear Enable Relay Coil shorted to ground	92
A039	Front Enable Relay contacts shorted to battery or relay ground open	94
A040	Rear Enable Relay contacts shorted to battery	96
A041	Brake Switch circuit open	98
A042	Low Pressure circuit open	100
A043	System voltage Low	102
A044	Right front wheel speed = 0	104
A045	Left front wheel speed = 0	110
A046	Right rear wheel speed = 0	116
A047	Left rear wheel speed = 0	122
A048	Excessive right front wheel acceleration	128
A049	Excessive left front wheel acceleration	134
A050	Excessive right rear wheel acceleration	140
A051	Excessive left rear wheel acceleration	146
A052	ABS Controller calibration error	152
A053	ABS Controller calibration error	154
A054	Rear Enable Relay Coil circuit open	156
A055	ABS Controller internal voltage fault	158
A056	Test 32 or 33 failed last or current ignition cycle	160
A057	Brake Switch Fuse Input is **Low (Ground)**	162
A058	Brake Lights Open, Ground Open	164
A059	Low Brake pressure while in an ABS stop	166
A060	ABS Controller internal fault	168
A061	System will not build pressure	170
A062	Low Accumulator pre-charge	172
A063	Both Rear Wheel speed sensors open	174

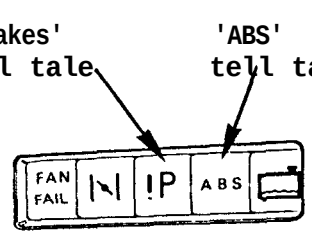
COMPONENT LOCATIONS



USA cars

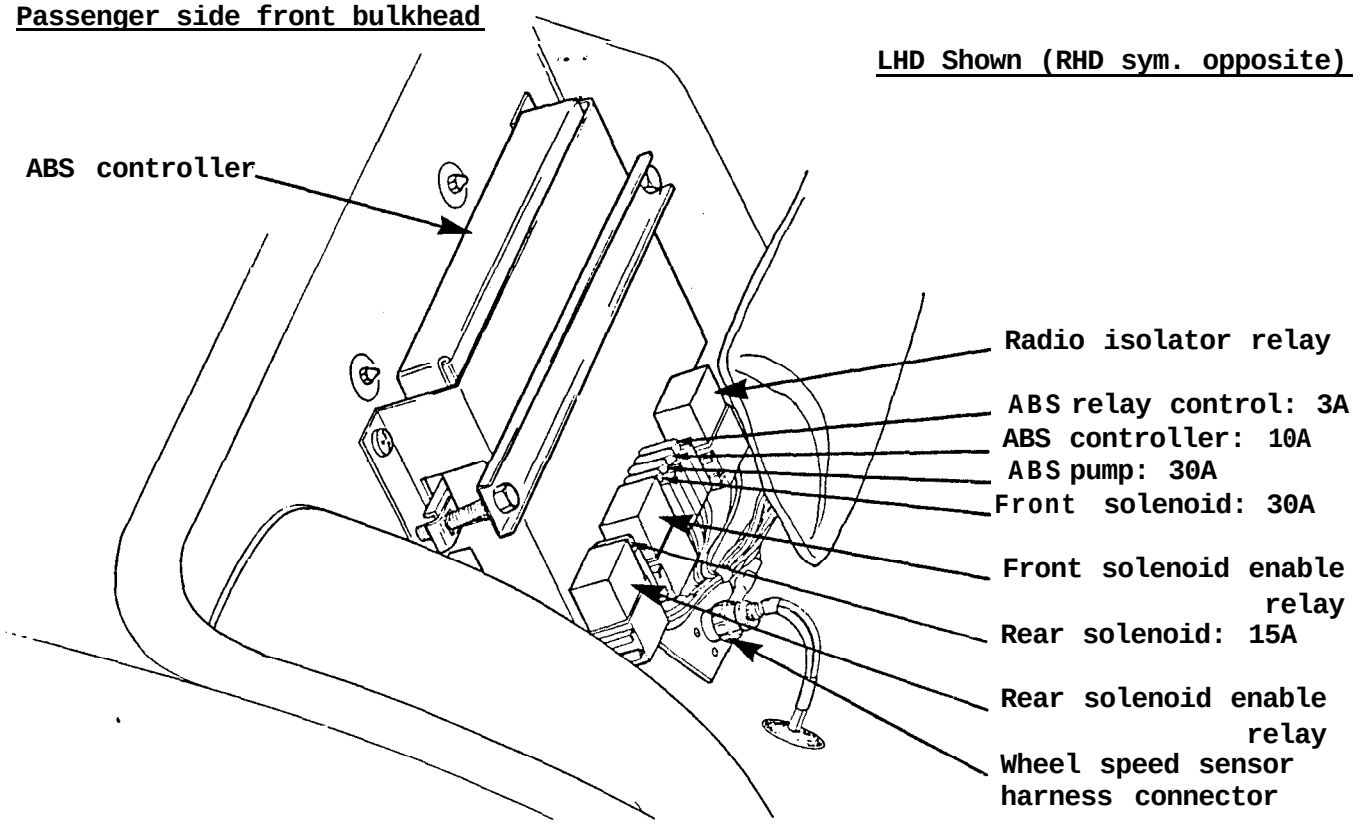


Non-USA cars



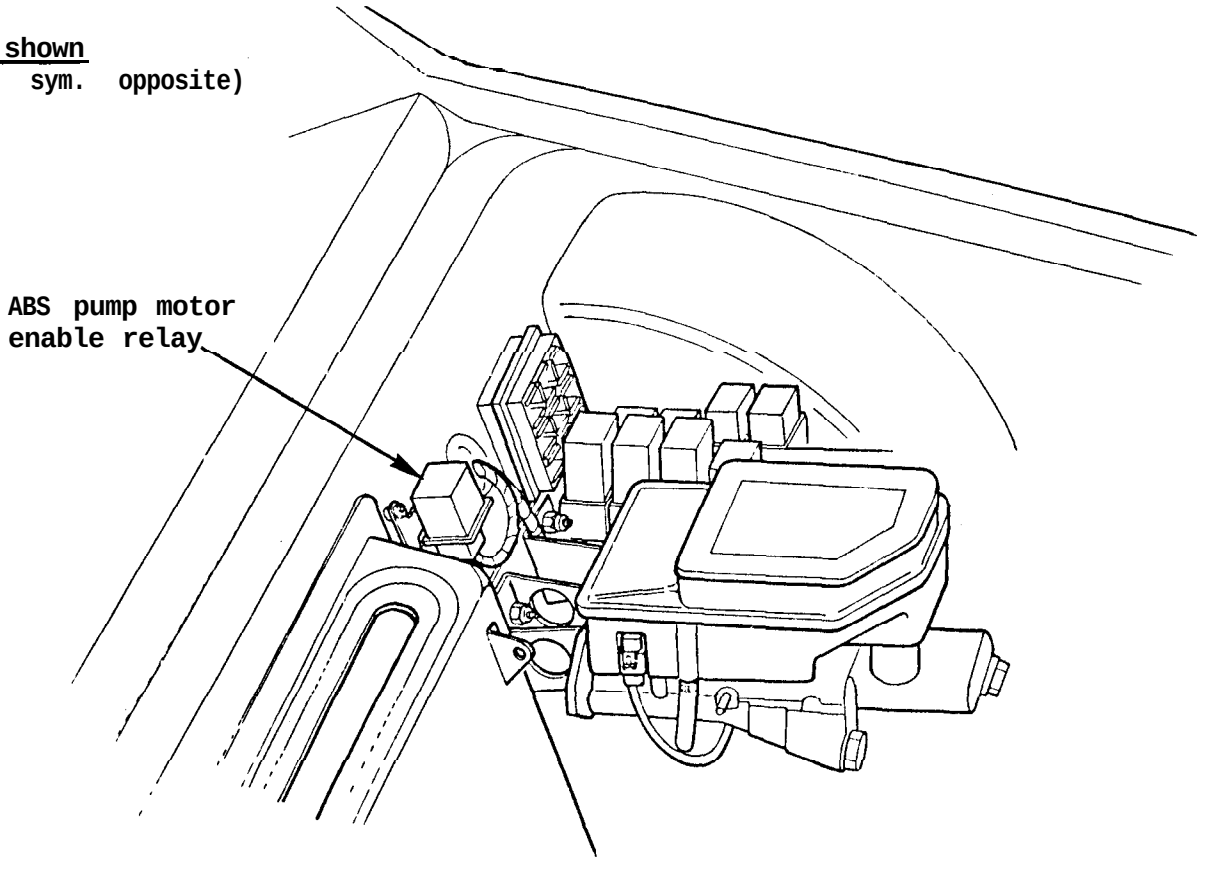
Passenger side front bulkhead

LHD Shown (RHD sym. opposite)



Driver's side front bulkhead

LHD shown
(RHD sym. opposite)



SYSTEM OPERATION

The Delco-Moraine Antilock Brake System (ABS) is designed to reduce the tendency of a wheel or wheels to lose traction (lockup) during braking. This results in improved vehicle braking performance by decreasing vehicle stopping distance, and assisting the driver in maintaining directional stability.

The ABS system accomplishes improved braking performance by: 1) Regulating the amount of braking force at any wheel to a value which will prevent locking. The ABS system prevents the wheels from losing traction and shortens stopping distance. A wheel which is rolling generally provides a shorter stopping distance than one which is sliding or skidding. 2) By keeping all four wheels at or near the same speed during braking, the ABS system helps the driver maintain directional stability.

It is important to remember that Antilock Brake Systems can improve braking performance, but cannot compensate for excessive speed, worn tires, worn brake components or driver error.

Under normal driving conditions, the Antilock Brake System does not operate; the vehicle uses its standard braking system. The Antilock Brake System will only operate when the ABS Controller detects an impending wheel lockup. The ABS Controller is able to detect this by monitoring the Brake Switch state and the four individual wheel speeds. When the brake pedal is depressed, the controller is alerted that the brakes have been applied and monitors each wheel speed. If the controller detects an impending wheel lockup or determines that a wheel or wheels are not decelerating equally, the controller will pulse the corresponding solenoids on and off rapidly. This activity can occur independently on each front wheel and on the rear wheel that begins to lock up first (select low). An ABS configuration of this type is commonly called a "Select Low 3-Channel System." When the solenoids are turned on and off, brake hydraulic pressure is applied or released at each wheel to equalize the individual wheel deceleration rates so that all the wheels are decelerating at the same speed or rate. When the Antilock Braking System is in operation, a clicking sound can be heard. This sound is the solenoids pulsing on and is a normal condition.

NOTICE: The -Antilock Brake System cannot increase the brake pressure above the master cylinder pressure applied by the driver and can never apply the brakes by itself.

CIRCUIT OPERATION

The Delco-Moraine Antilock Brake Electrical System consists of an ABS Controller, four 'wheel speed sensors, the Brake Switch, Pump Motor Relay, ABS Tell Tale, Brake Tell Tale, Accumulator Pressure Switch, a Front Enable and a Rear Enable Relay, one Rear Solenoid, two Front Solenoids, Serial Data Line, Lamp Driver Module and associated wiring. Refer to Figure 3 on page 14 for Electric Schematic Diagram.

ABS CONTROLLER

The ABS Controller is the central component in the Antilock Brake System. The controller's primary function is to monitor the speed of each wheel and determine if any wheel is approaching lockup during braking. If such a condition is detected, the controller will pulse the appropriate solenoids to adjust brake pressures for maximum stopping control without locking the wheels.

The ABS Brake Controller also monitors itself and other ABS components for malfunctions. If the controller detects a malfunction, it will store a trouble code in its memory and will warn the driver by turning on or flashing the ABS Tell Tale. The trouble code can later be accessed by the service technician using the TECH 1 connected to the ALDL-Plug.

FRONT ENABLE RELAY

During normal operation, the Front Enable Relay applies voltage to the front solenoids.

This occurs once the ABS Controller has completed the initialization cycle and has detected no faults in the ABS system. The controller will then energize the Front Enable Relay by grounding its coil. The relay contacts close and voltage is applied to the Front Solenoids from Fuse "E".

If during the initialization cycle or vehicle operation the controller detects a fault or loses power or ground, the controller will de-energize the Front Enable Relay by removing its ground. The ABS Tell Tale will light since it is grounded through the relay contacts.This is a failsafe feature to insure that the operator is warned that ABS has been disabled. It also prevents front solenoid operation by removing power to the solenoids in the event a solenoid is shorted to ground.

REAR ENABLE RELAY

The Rear Enable Relay operates in the same manner as the Front Enable Relay except that it applies voltage to the rear solenoids and will not ground the ABS Tell Tale when it is de-energized.

FRONT AND REAR SOLENOIDS

When the Enable Relays are energized, voltage is applied to the solenoids. If the solenoid controls are closed, ground is applied and the solenoids are energized. During an ABS stop, the controller pulses the solenoid controls on and off several times a second. This rapid cycling of the solenoids applies and releases brake pressure at the affected wheel, preventing lockup.

WHEEL SPEED SENSOR

The Wheel Speed Sensors generate an AC voltage as a magnetic toothed ring passes a stationary coil. The frequency of this AC voltage is used to determine the speed of each wheel. By comparing the wheel speeds during braking, the ABS Controller is able to determine if a wheel lockup is about to occur.

BRAKE SWITCH

When the brake pedal is depressed, the Brake Switch closes and voltage is applied to the brake apply input of the ABS Controller. This signals the controller that the brakes have been applied, and the controller will now activate ABS if it determines it is needed.

PUMP MOTOR CIRCUIT

The pump motor circuit consists of a Pump Motor, Pump Motor Relay, Accumulator Pressure Switch and ABS Controller. When the ignition is in RUN, voltage is,applied to the Pump Motor Relay coil from ABS fuse "A". If accumulator pressure drops below approximately 2200 PSI,the Accumulator Pressure Switch closes, grounding the Pump Motor Relay coil and energizing the relay. The relay contacts close, allowing voltage to be applied to the Pump Motor and the "Pump On Input" Terminal at the ABS Controller. The Pump Motor will continue to run until accumulator pressure reaches approximately 2700 PSI, when the accumulator switch contacts open causing the Pump Motor Relay to de-energize. The ABS Controller does not control the operation of the pump motor but does monitor the Pump motor circuit for proper operation by way of the Pump On Input. If the controller detects a problem in the Pump motor circuit such as excessively long pump run times or no pump runs after several brake applications, the controller will set a code and warn the driver.

ABS TELL TALE

A flashing ABS Tell Tale indicates that the system has been degraded by a malfunction but that the driver still has ABS capabilities. If the indicator is on all the time this signals the driver that the malfunction will not allow proper operation of the Antilock Brake System and that the controller has shut the system down, reverting to the vehicle's base brake system.

NOTICE: Prolonged vehicle operation with a flashing ABS tell tale may further damage the ABS system and may cause complete ABS system failure.

LAMP DRIVER MODULE

The Lamp Driver Module turns on the Brake Tell Tale when accumulator pressure falls below approximately 1800 PSI. The Lamp Driver Module is grounded at Terminal C through the accumulator switch. When accumulator pressure falls below approximately 1800 PSI the switch opens. The Lamp Driver Module senses the Accumulator Pressure Switch is no longer grounded, and turns on the Brake Tell Tale by grounding it.

SELF DIAGNOSTIC CAPABILITIES

The ABS Controller has diagnostic capabilities which allow it to detect malfunctions in itself or its related circuitry. The controller runs tests to detect malfunctions at different times during vehicle operation. For example, when the ignition is first turned to run, a clicking sound can be heard. This is the initialization cycle. At this time, the controller turns on the enable relays and cycles the solenoids to detect a malfunction within the relay circuitry. While the vehicle is operating, the ABS Controller is constantly monitoring and performing tests such as wheel speed data, state of the Accumulator Switch and the condition of the solenoids and relays. In the event the controller detects a malfunction, the controller will store a diagnostic code and notify the driver that a malfunction exists by turning on or flashing the ABS Tell Tale.

DIAGNOSIS

Diagnosis of an Antilock Brake System malfunction involves two basic steps. These steps must be followed in order to isolate the fault accurately, determine its cause, and repair the condition with the least amount of diagnostic time. The proper diagnostic procedure consists of a Pre-Diagnosis Inspection, followed by determining if any current trouble codes have been set in the ABS Controller's memory.

PRE-DIAGNOSIS INSPECTION

Pre-Diagnosis Inspection consists of a quick visual check of specific system components which could create an apparent ABS system malfunction. Performing this quick inspection of the system prior to diagnosing specific symptoms may result in isolation of a simple failure which may be the cause of an inoperative system. This should be the first step in analyzing a customer complaint. Refer to the chart on page 11 for the Pre-Diagnosis Inspection.

TROUBLE CODES

In the process of controlling the Antilock Brake System the ABS Controller continually monitors operating conditions for possible system malfunctions. By comparing system conditions against standard operating limits, certain circuit and component malfunctions can be detected. A four-digit numerical "Trouble Code" is stored in computer memory when a problem is detected by this self-diagnostic system.

These "Trouble Codes" can later be accessed by the service technician with the TECH **1.**

In order to access the trouble codes, connect the TECH 1 to the ALDL Connector and follow the TECH 1 manufacturer's instructions to read the codes. A current code indicates that the malfunction occurred during the current ignition cycle. History codes are malfunctions which do not currently exist but could possibly aid in determining the cause of an intermittent condition.

After the trouble codes have been read, proceed to the appropriate trouble code diagnosis

NOTE: Always turn off the Ignition prior to initial troubleshooting to ensure all diagnostic data is preserved. If the ignition is not turned off prior to reading fault codes, any information stored for a fault in the last drive cycle will be lost.

ADDITIONAL DIAGNOSTIC CAPABILITIES

In addition to being able to set troubles codes, the ABS Controller is equipped with a sophisticated on-board diagnostic system. The on-board diagnostic system, when accessed with the TECH **1,** is designed to aid the service technician in identifying the source of a fault as specifically as possible and whether or not the fault is intermittent. Refer to the Figure 2 on page 12 for the TECH 1 ABS Data List.

ABS SNAPSHOT

The ABS snapshot feature can be used to identify deviations in data which may cause a trouble code to set intermittently. The snapshot feature will store the ABS data list parameters for a period of time before, during and after a trigger. A trigger can be set to take a snapshot for any ABS code, a specific ABS code or at your command. Refer to the TECH 1 instructions on how to utilize this feature.

MANUAL RELAY AND SOLENOID CONTROL

This feature allows the front and rear enable relays and the individual hold and release solenoids to be commanded on or off and will also display the actual output or voltage level (HI or LO) at that particular terminal on the TECH 1. The solenoids can only be commanded on for a 60 second period. After this period the solenoids will automatically be turned off to cool, Refer to the TECH **1** instructions on how to utilize this feature.

ENHANCED DIAGNOSTICS (TECH 1 MODE:F1: CODE HISTORY)

This feature can be used to determine if a trouble code is intermittent, identify how intermittent the trouble code is and give information regarding vehicle operating conditions when the most recent trouble code was set. The enhanced diagnostic feature will display the following information when accessed.

- The first five (5) trouble codes that occurred in the order in which they occurred.This information can be used to identify situations where the conditions explain the occurrence of a later fault. An example is an intermittent wheel speed sensor which fails code AO48, then further degrades such that no signal is present and now fails code A044.
- How often each of the first five (5) trouble codes have occurred. This information identifies intermittent fault conditions and the degree of intermittence. If a trouble code , sets **1** out of 35 drive cycles, an unusual condition may have been encountered, such as a severe pot hole, that caused the fault. Up front, you know special diagnosis techniques are needed to identify the cause. if the trouble code occurred 10 out of 15 drive cycles, your chances of identifying the fault are much greater and recreation is probably much easier. Again, you know this before any attempt is made to identify the cause. If the trouble code occurs every drive cycle, the fault is "HARD" or easy to duplicate. Diagnosis should be easier.
- The last trouble code that set is identified specifically. This trouble code is what brought the customer in for repair. Additionally, the following information identifies what was happening when the last trouble code set.

  The speed the ABS controller believes the vehicle was going at the time the fault occurred. An unreasonable number here may lead you to suspect wheel speed sensor problems.

  The state of the brake switch at the time of the trouble code sets (ON, OFF or OPEN). This will identify if any braking was being done when the fault occurred.

NOTICE: Only the state of the brake switch is known. The brake pedal may have simply been depressed or shorted, and no actual vehicle deceleration was occurring.

The status of the system brake pressure. If the system pressure was LOW, a leak may exist **or** a pump problem may exist that adversely affects the braking performance of the system.

Whether or not the brake had been depressed this ignition cycle. If the brake switch circuit was OPEN, no brake input will be seen. Also, many drivers do not depress the brake when starting the car but do prior to putting the car in gear. If no brake input was seen prior to the fault and the brake switch circuit is ON or OFF, this information tells you the fault was probably detected shortly after the ignition switch was turned on.

Whether or not an ABS stop was in progress when the fault occurred. This may point to a fault caused by additional stresses or vibration the vehicle encountered when in the ABS stop.

How many drive cycles (a drive cycle occurs when the ignition is on and vehicle is driven faster than 10 MPH) since the last trouble code set. If zero (0) drive cycles have occurred, the customer drove in with the fault detected (ABS Warning Light probably flashing or on continuously). If five (5) drive cycles have occurred, no fault was present when the vehicle arrived for service. If no fault has occurred for 40 drive cycles, and only occurred once based on the intermittent information, the fault may have occurred under unusual circumstances and a true "fault" may not exist,

NOTE: If no ABS trouble codes have been set for 50 drive cycles, the ABS controller will clear itself of all fault information.

NOTE ON INTERMITTENTS

The diagnostic procedures in this section may or may not be helpful in determining the cause -of intermittent problems in the Antilock Brake System electrical components. In most cases, the fault must be present to locate the problem effectively using the trouble trees.

Most intermittent problems are caused by faulty electrical connections or wiring. When an intermittent failure is encountered:

- Check for history codes which may be stored in the ABS Controller. If a history code is stored this may indicate the circuitry which has the intermittent condition. Move the related connectors, harness and components in an effort to induce the failure.
- Enter the Enhanced Diagnostic feature. This feature will help determine how intermittent the fault is and may help you determine certain conditions that cause the fault to occur.
- Set the ABS snapshot to trigger on the intermittent trouble code and use the enhanced diagnostic feature to recreate the conditions that may cause the intermittent code to set. Review the ABS snapshot data to determine the cause of trigger.
- Check for poor mating of connector halves or terminals not fully seated in the connector body (backed out).
- Utilize the TECH 1 snapshot data while manipulating wiring and connectors. Observe the data parameters sudden changes.
- Check for improperly formed or damaged terminals. All connector terminals in a problem circuit should be carefully reformed to increase contact tension.
- Check for poor terminal to wire connection. This requires removing the terminal from the connector body to inspect.

ANTILOCK BRAKE SYSTEM SERVICE PRECAUTIONS

The Antilock Brake System is designed to withstand normal current draws associated with vehicle operation. However, care must be taken to avoid overloading any of these circuits. In testing for opens and shorts, do not ground or apply voltage to any of the circuits unless instructed to do so by the diagnostic procedures. These circuits should only be tested using a High Impedance Multimeter if they remain connected to the Antilock Brake Controller. Power should never be removed or applied to the controller with the key in the RUN position. Before removing or connecting battery cables, fuses or connectors always turn the ignition to the LOCK position.

Some operations in this section require that hydraulic lines, hoses and fittings be disconnected for inspection or testing purposes. This brake system uses a hydraulic accumulator which, when fully charged, contains brake fluid at high pressure. **Before disconnecting any hydraulic lines, hoses or fittings, be sure that the accumulator is fully depressurized. Failure to depressurize the hydraulic accumulator may result in personal injury.**

ANTILOCK BRAKE SYSTEM DIAGNOSTICS CAN NOT BE ENTERED

If the ABS Tell Tale is lit but diagnostics cannot be entered with the TECH **1,** proceed to the diagnosis on page 16. This condition indicates that the ABS Controller has lost power, ground or the serial data line.

PRE-DIAGNOSIS INSPECTION		
ITEM	**INSPECT FOR:**	**CORRECTIVE ACTION**
BRAKE FLUID RESERVOIR, HYDRAULIC PUMP/ACCUMULATOR POWER MASTER III A ASSEMBLY, BRAKE CALIPERS AND BRAKE HOSES AND LINES	– LOW BRAKE FLUID LEVEL – EXTERNAL LEAKS – BINDING OR STICKING CALIPERS	– FILL RESERVOIR – REPAIR LEAKS AS REQUIRED – REPAIR AS NEEDED
PARKING BRAKE	– FULL RELEASE	– RELEASE PARKING BRAKE – ADJUST CABLE IF REQUIRED
BATTERY	– ADEQUATE CHARGE	– CHARGE OR REPLACE BATTERY AS REQUIRED – SERVICE CHARGING SYSTEM AS REQUIRED
FUSES • ABS FUSE “A” 3 AMP • STOP FUSE “C” 15 AMP . TALE FUSE "B" 5 AMP . CONTROLLER FUSE "G" 10 AMP . REAR ENABLE RELAY FUSE “D” 15AMP . PUMP MOTOR RELAY FUSE “F” 30 AMP . FRONT ENABLE RELAY FUSE “E” 30 AMP	– BLOWN FUSE	– REPLACE FUSE AND VERIFY OPERATION
CONNECTORS • ABS CONTROLLER . PUMP MOTOR RELAY . PUMP MOTOR . ACCUMULATOR PRESSURE SWITCH . REAR ENABLE RELAY . FRONT ENABLE RELAY . RIGHT FRONT SOLENOID . LEFT FRONT SOLENOID • REAR SOLENOID . WHEEL SPEED SENSORS • LAMP DRIVER MODULE . DIODE	– PROPER ENGAGEMENT OF CONNECTOR – LOOSE WIRES IN CONNECTOR	– PROPERLY ENGAGE CONNECTORS – REPAIR LOOSE WIRES
GROUND J2-A, J2-B	– CLEAN AND TIGHT CONNECTION	– TIGHTEN – REPAIR LOOSE WIRES
TELL TALES OPERATIONAL DURING BULB TEST . ABS TELL TALE • BRAKE TELL TALE	– ILLUMINATED DURING ENGINE CRANKING	– CHECK CONNECTIONS – REPLACE BULB AND VERIFY OPERATION

Figure 1 - Pre-Diagnosis Inspection

IGNITION "ON" / ENGINE "OFF" / INITIALIZATION MODE FINISHED

TECH 1 ABS DATA LIST		
TECH 1 POSTION	**UNITS DISPLAYED**	**TYPICAL DATA VALUE**
FRONT WHL SPEEDS	MPH or KPH	0 MPH (Standing vehicle)
REAR WHL SPEEDS	MPH or KPH	0 MPH (Standing vehicle)
VEHICLE SPEED	MPH or KPH	0 MPH (Standing vehicle)
BRAKE FUSE INPUT	LOW / HIGH /CIRCUIT OPEN	HIGH
ABS BATT VOLTAGE	VOLTS	> 11.0 Volts
ABS BATT VOLTAGE	OK FOR OPER / LOW	OK FOR OPER
ABS WARNING LITE	OFF / ON/FLASHING	OFF
BRAKES AVAILABLE	ANTI-LOCK/BASE BRAKES ONLY/REAR ABS ONLY	ANTI-LOCK
BRAKE SWITCH	ON /OFF/CIRCUIT OPEN	OFF (Brake Pedal not depressed) ON (Brake Pedal depressed)
PUMP MOTOR	ON / OFF/CIRCUIT OPEN	OFF
BRAKE PRESSURE	OK (> 1800 PSI) CIRCUIT OPEN LOW (< 1800 PSI)	OK (> 1800 PSI)
FRT ENABLE RELAY	ON / OFF	ON
REAR ENABL RELAY	ON / OFF	ON
LF HOLD SOLENOID	ON /OFF	OFF
LF HOLD SOL FDBK	HIGH / LOW	HIGH
LF RELEASE SOL	ON / OFF	OFF
LF REL SOL FDBK	HIGH / LOW	HIGH
RF HOLD SOLENOID	ON / OFF	OFF
RF HOLD SOL FDBK	HIGH / LOW	HIGH
RF RELEASE SOL	ON / OFF	OFF
RF REL SOL FDBK	HIGH / LOW	HIGH
REAR HOLD SOL	ON/OFF	OFF
REAR HOLD SOL FB	HIGH / LOW	HIGH
REAR RELEASE SOL	ON/OFF	OFF
REAR REL SOL FB	HIGH / LOW	HIGH

Figure 2 - TECH 1 ABS Data List

NOTICE:

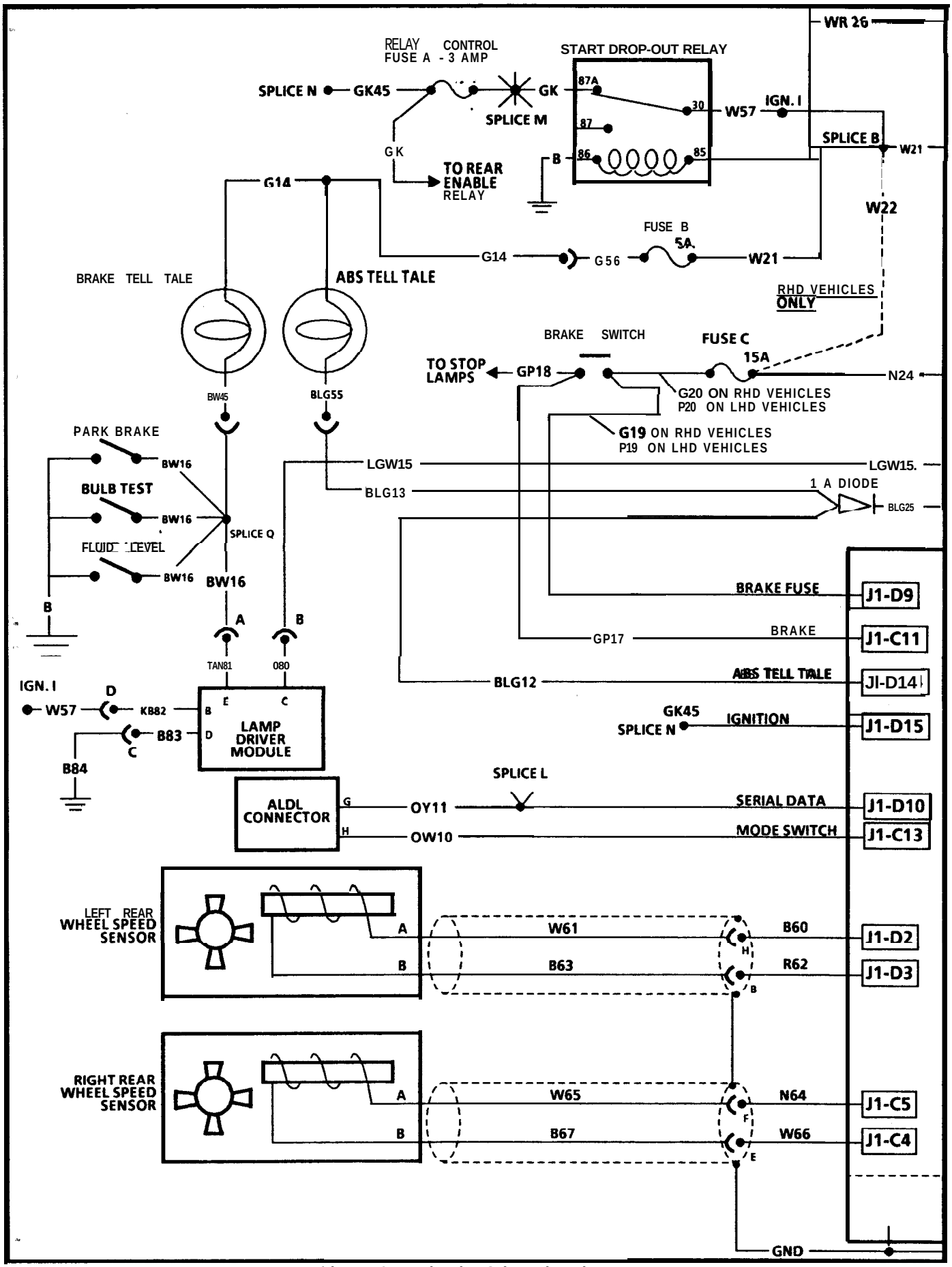


Figure 3 - Electric Schematic Diagram

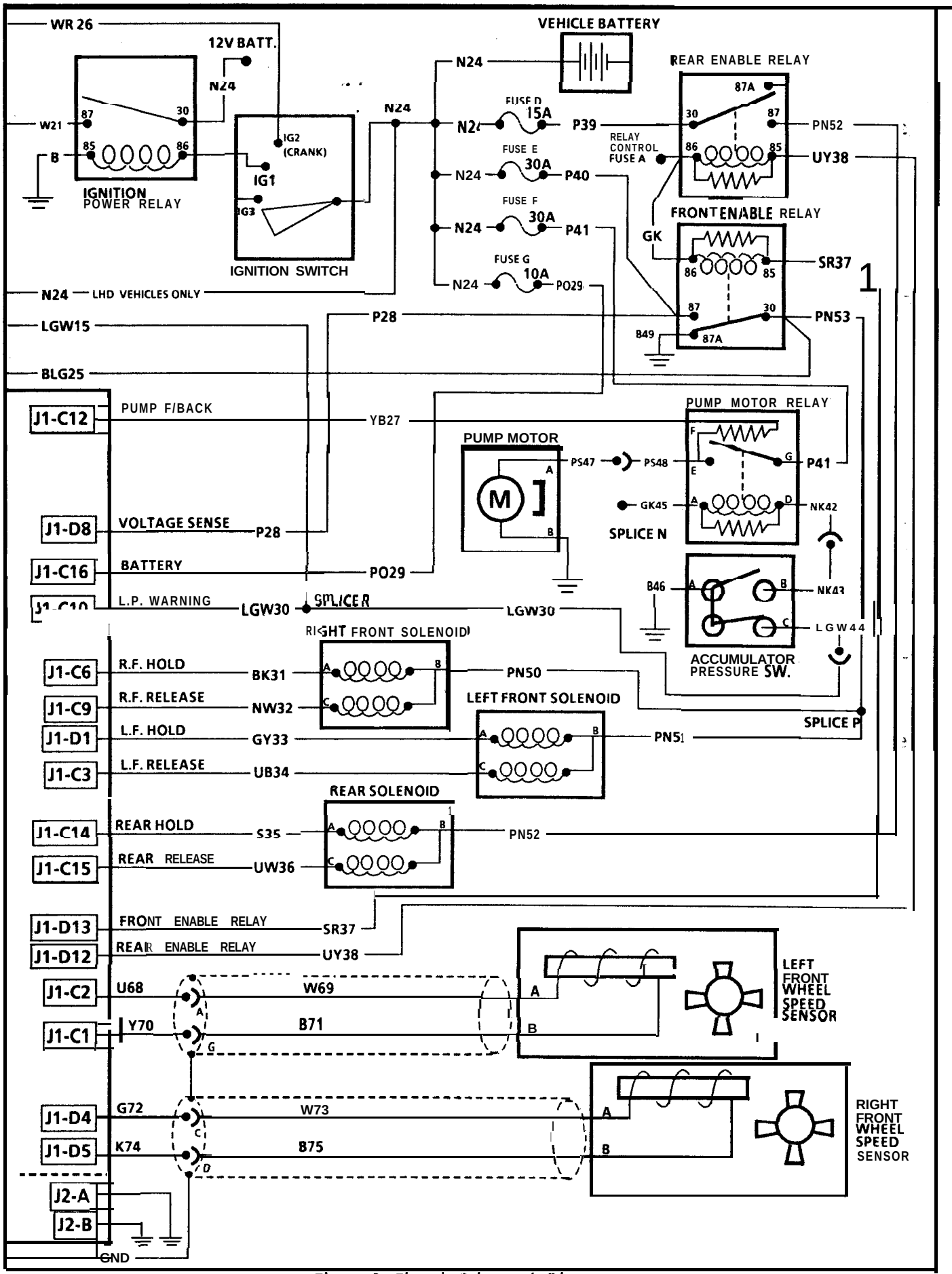
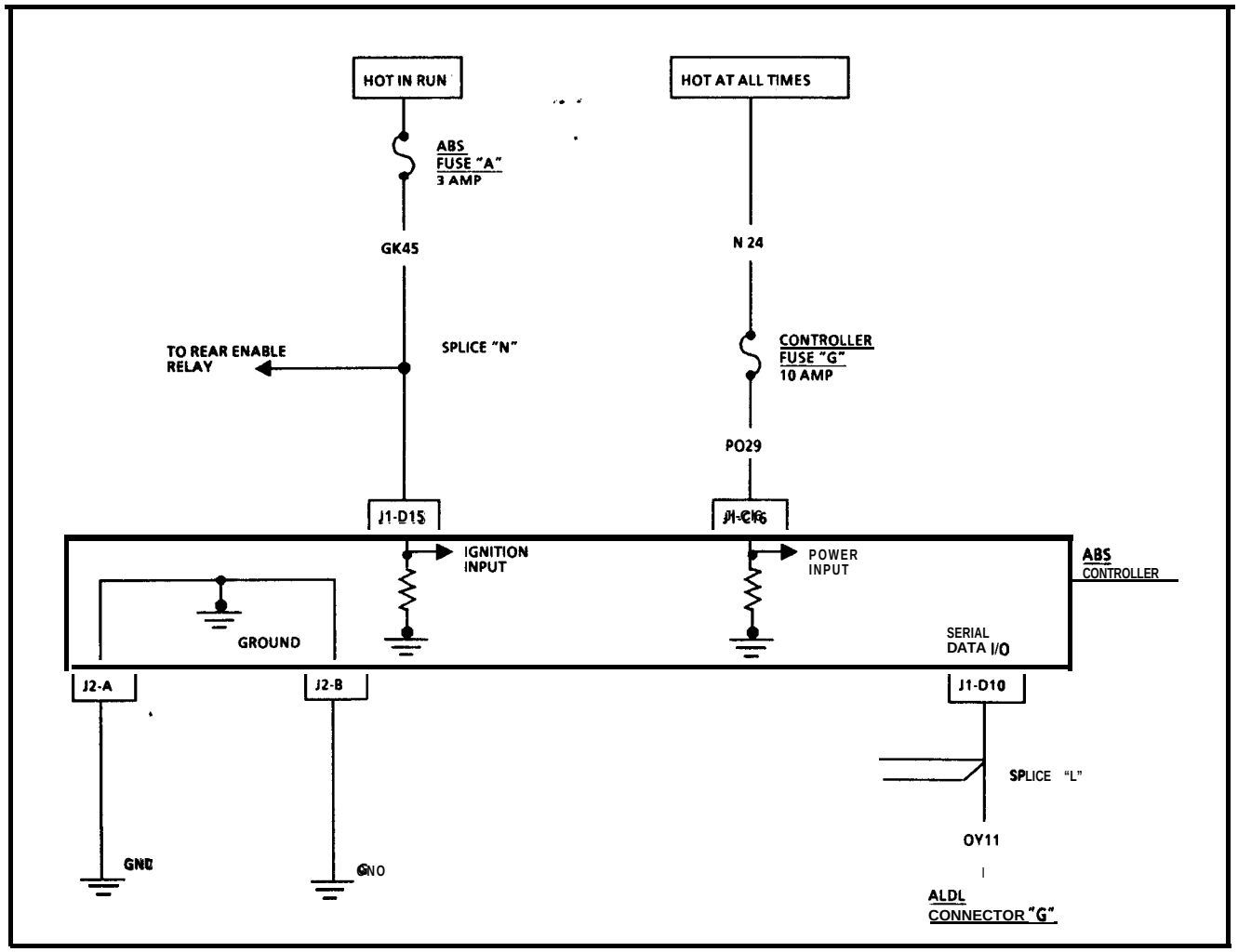


Figure 3 - Electric Schematic Diagram



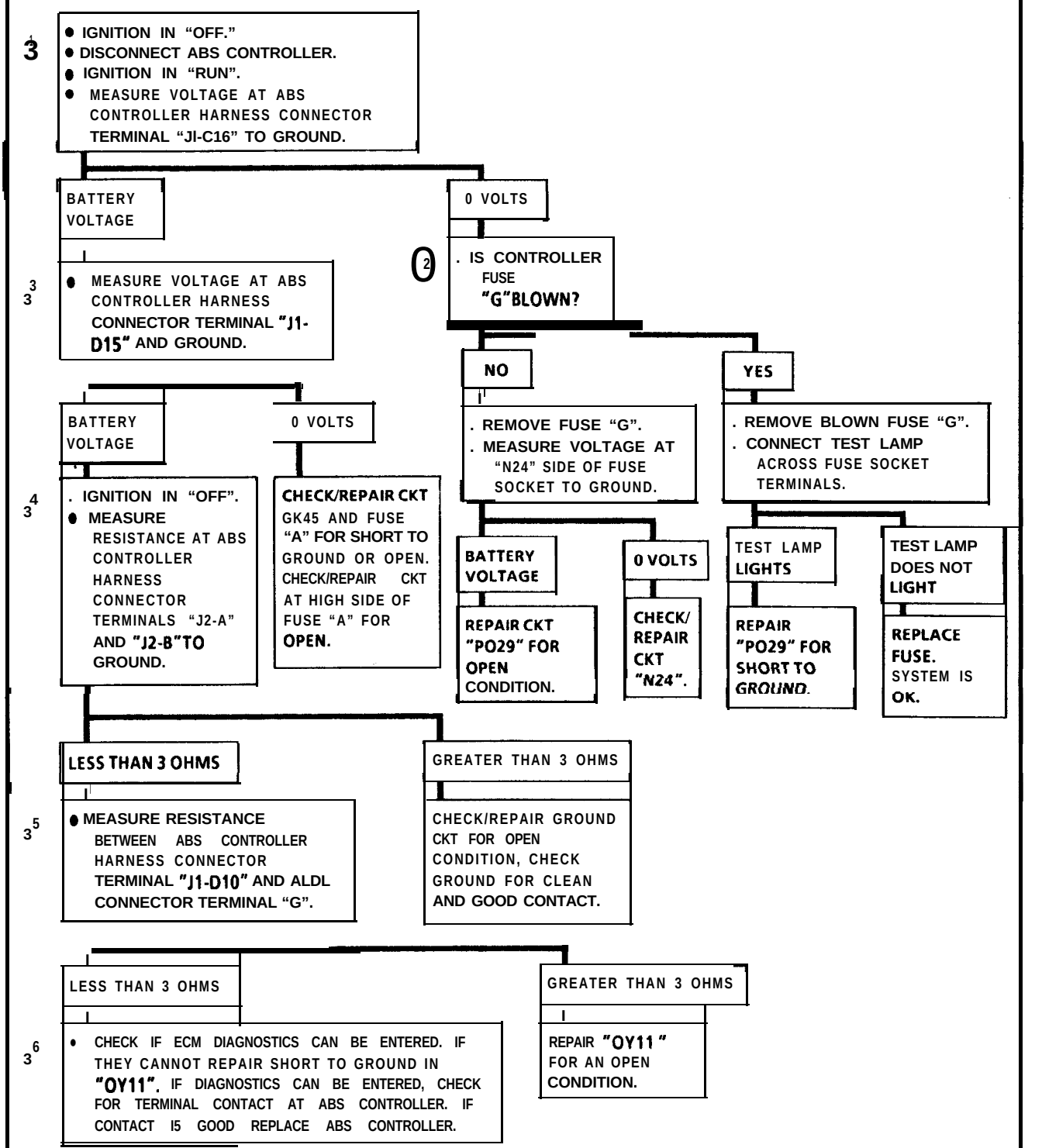
ANTILOCK BRAKE SYSTEM DIAGNOSTICS CANNOT BE ENTERED

The Antilock Brake System will be disabled and the ABS Tell Tale will be on if a loss of power or ground occurs at the ABS Controller. A loss of power or ground at the controller or an open or shorted serial data line will also prevent access to the Antilock Brake System's diagnostics.

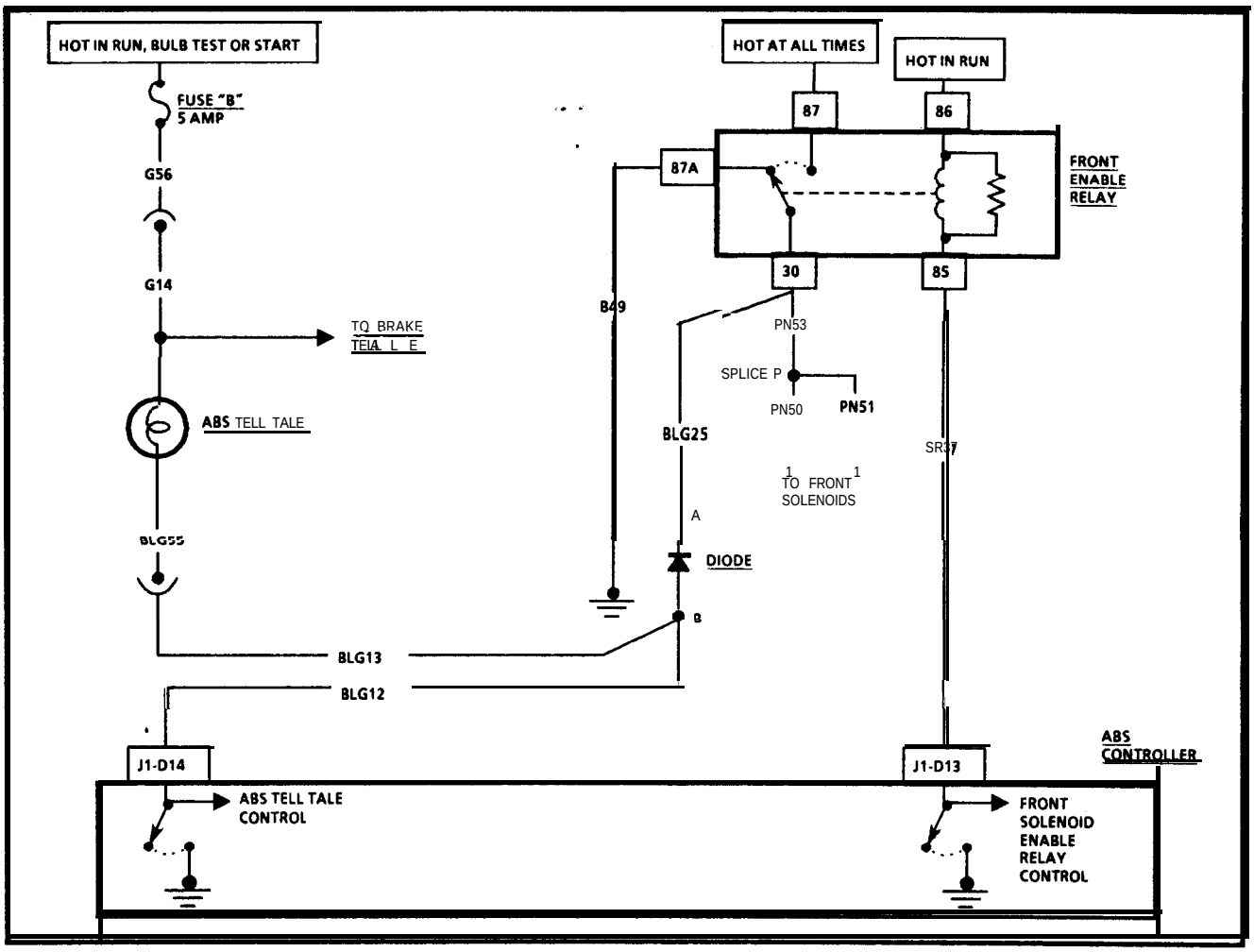
Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. Determines if voltage is being applied to the ABS Controller at Terminal J1-C16.
2. Indicates whether the fault is due to open condition or a possible short to ground in PO 29.
3. Determines if voltage is being applied to ABS Controller at Terminal Jl-D15.
4. A measurement of greater than 3 ohms indicates an open condition in the ABS Controller's ground circuits.
5. A measurement of greater than 3 ohms indicates an open condition exists in the data line OY11. If an open condition exists in the data line, the controller would be unable to communicate with the TECH 1.
6. If a short to ground existed in OY11, communication with the ECM would not be possible. If communication with the ECM is possible, a poor terminal connection at the ABS Controller is indicated or the controller is defective.

ANTILOCK BRAKE SYSTEM DIAGNOSTICS CANNOT BE ENTERED


3
• IGNITION IN "OFF."
• DISCONNECT ABS CONTROLLER.
• IGNITION IN "RUN".
• MEASURE VOLTAGE AT ABS CONTROLLER HARNESS CONNECTOR TERMINAL "Jl-C16" TO GROUND.
BATTERY VOLTAGE
0 VOLTS
0
2
. IS CONTROLLER FUSE "G" BLOWN?
NO
YES
3
3
• MEASURE VOLTAGE AT ABS CONTROLLER HARNESS CONNECTOR TERMINAL "J1-D15" AND GROUND.
BATTERY VOLTAGE
0 VOLTS
. REMOVE FUSE "G".
. MEASURE VOLTAGE AT "N24" SIDE OF FUSE SOCKET TO GROUND.
. REMOVE BLOWN FUSE "G".
. CONNECT TEST LAMP ACROSS FUSE SOCKET TERMINALS.
3 4
. IGNITION IN "OFF".
• MEASURE RESISTANCE AT ABS CONTROLLER HARNESS CONNECTOR TERMINALS "J2-A" AND "J2-B" TO GROUND.
CHECK/REPAIR CKT GK45 AND FUSE "A" FOR SHORT TO GROUND OR OPEN. CHECK/REPAIR CKT AT HIGH SIDE OF FUSE "A" FOR OPEN.
BATTERY VOLTAGE
0 VOLTS
REPAIR CKT "P029" FOR OPEN CONDITION.
CHECK/ REPAIR CKT "N24".
TEST LAMP LIGHTS
TEST LAMP DOES NOT LIGHT
REPAIR "P029" FOR SHORT TO GROUND.
REPLACE FUSE. SYSTEM IS OK.
LESS THAN 3 OHMS
GREATER THAN 3 OHMS
3 5
• MEASURE RESISTANCE BETWEEN ABS CONTROLLER HARNESS CONNECTOR TERMINAL "J1-D10" AND ALDL CONNECTOR TERMINAL "G".
CHECK/REPAIR GROUND CKT FOR OPEN CONDITION, CHECK GROUND FOR CLEAN AND GOOD CONTACT.
LESS THAN 3 OHMS
GREATER THAN 3 OHMS
3 6
• CHECK IF ECM DIAGNOSTICS CAN BE ENTERED. IF THEY CANNOT REPAIR SHORT TO GROUND IN "OY11". IF DIAGNOSTICS CAN BE ENTERED, CHECK FOR TERMINAL CONTACT AT ABS CONTROLLER. IF CONTACT I5 GOOD REPLACE ABS CONTROLLER.
REPAIR "OY11" FOR AN OPEN CONDITION.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A001

ABS TELL TALE OPEN OR SHORTED TO GROUND

When the Front Enable Relay is energized, its contacts close. This opens the ground path from the ABS Tell Tale. Voltage from Fuse "B" should now be present at terminal **"J1-D14"**.

CODE A001 will set when all of the following conditions exist:

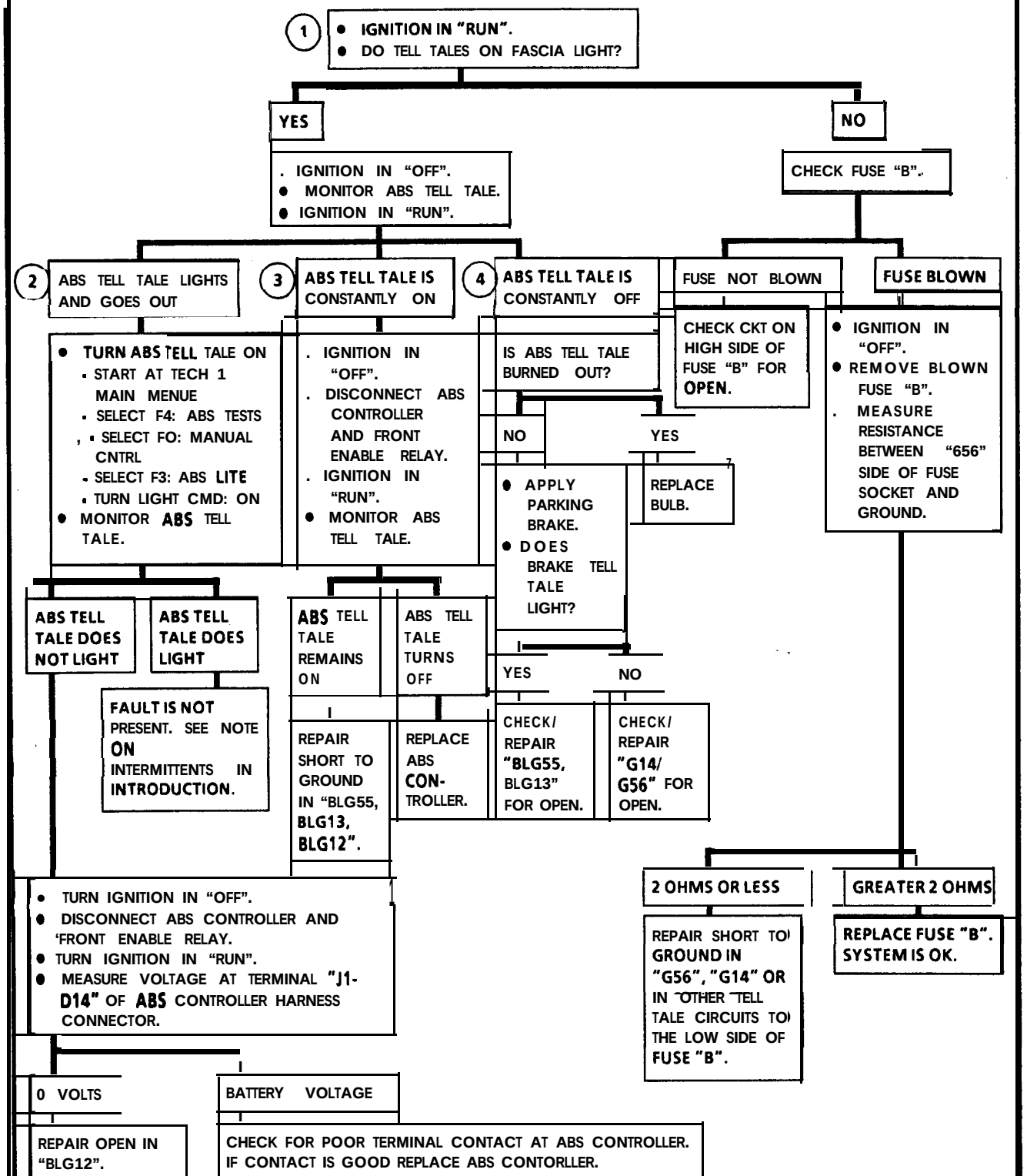
- The Front Enable Relay is energized.
- The ABS Tell Tale Control is open.
- The ABS Controller senses no voltage at terminal "Jl-D14".

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

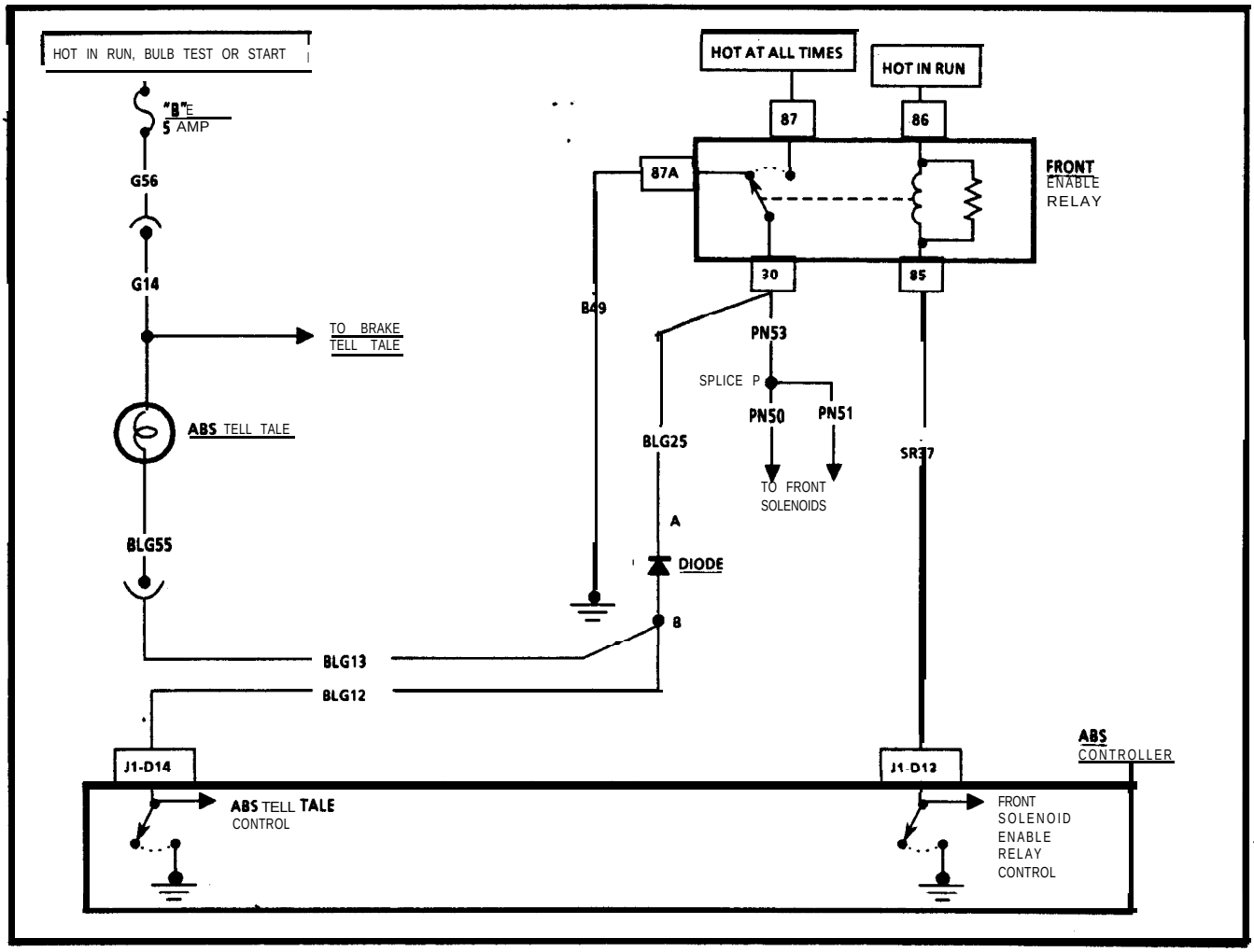
1. If the ABS Tell Tale lights, the circuit to Fuse "B" is good.
2. If the ABS Tell Tale lights and goes out, an open circuit **"BLG12"** or an intermittent fault exists.
3. If the ABS Tell Tale is constantly on, a short to ground in circuits "BLG55, **BLG13, BLG12"** or an internal ABS Controller fault exists.
4. If the ABS Tell Tale is constantly off, an open condition in "BLG55, **BLG13",** or **"G14/G56",** or a burned out bulb is the failure.

CODE A001

ABS TELL TALE OPEN OR SHORTED TO GROUND


1
• IGNITION IN "RUN".
• DO TELL TALES ON FASCIA LIGHT?
YES
NO
. IGNITION IN "OFF".
• MONITOR ABS TELL TALE.
• IGNITION IN "RUN".
CHECK FUSE "B".
2
ABS TELL TALE LIGHTS AND GOES OUT
3
ABS TELL TALE IS CONSTANTLY ON
4
ABS TELL TALE IS CONSTANTLY OFF
FUSE NOT BLOWN
FUSE BLOWN
• TURN ABS TELL TALE ON
- START AT TECH 1 MAIN MENUE
- SELECT F4: ABS TESTS
- SELECT FO: MANUAL CNTRL
- SELECT F3: ABS LITE
- TURN LIGHT CMD: ON
• MONITOR ABS TELL TALE.
. IGNITION IN "OFF".
. DISCONNECT ABS CONTROLLER AND FRONT ENABLE RELAY.
. IGNITION IN "RUN".
• MONITOR ABS TELL TALE.
IS ABS TELL TALE BURNED OUT?
CHECK CKT ON HIGH SIDE OF FUSE "B" FOR OPEN.
• IGNITION IN "OFF".
• REMOVE BLOWN FUSE "B".
. MEASURE RESISTANCE BETWEEN "656" SIDE OF FUSE SOCKET AND GROUND.
NO
YES
REPLACE BULB.
• APPLY PARKING BRAKE.
• DOES BRAKE TELL TALE LIGHT?
ABS TELL TALE DOES NOT LIGHT
ABS TELL TALE DOES LIGHT
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
ABS TELL TALE REMAINS ON
ABS TELL TALE TURNS OFF
YES
NO
REPAIR SHORT TO GROUND IN "BLG55, BLG13, BLG12".
REPLACE ABS CONTROLLER.
CHECK/ REPAIR "BLG55, BLG13" FOR OPEN.
CHECK/ REPAIR "G14/ G56" FOR OPEN.
• TURN IGNITION IN "OFF".
• DISCONNECT ABS CONTROLLER AND FRONT ENABLE RELAY.
• TURN IGNITION IN "RUN".
• MEASURE VOLTAGE AT TERMINAL "J1-D14" OF ABS CONTROLLER HARNESS CONNECTOR.
2 OHMS OR LESS
GREATER 2 OHMS
REPAIR SHORT TO GROUND IN "G56", "G14" OR IN OTHER TELL TALE CIRCUITS TO THE LOW SIDE OF FUSE "B".
REPLACE FUSE "B". SYSTEM IS OK.
0 VOLTS
BATTERY VOLTAGE
REPAIR OPEN IN "BLG12".
CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER. IF CONTACT IS GOOD REPLACE ABS CONTORLLER.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE.
NHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A002

ABS TELL TALE SHORTED TO BATTERY OR DIODE SHORTED

The Diode prevents battery voltage from being applied to the ABS Tell Tale when the Front Enable Relay is energized. If the ABS Controller is inoperative, the Diode allows the ABS Tell Tale to be grounded through the deenergized Front Enable Relay.

CODE A002 will set during system initialization when all of the following conditions exist:

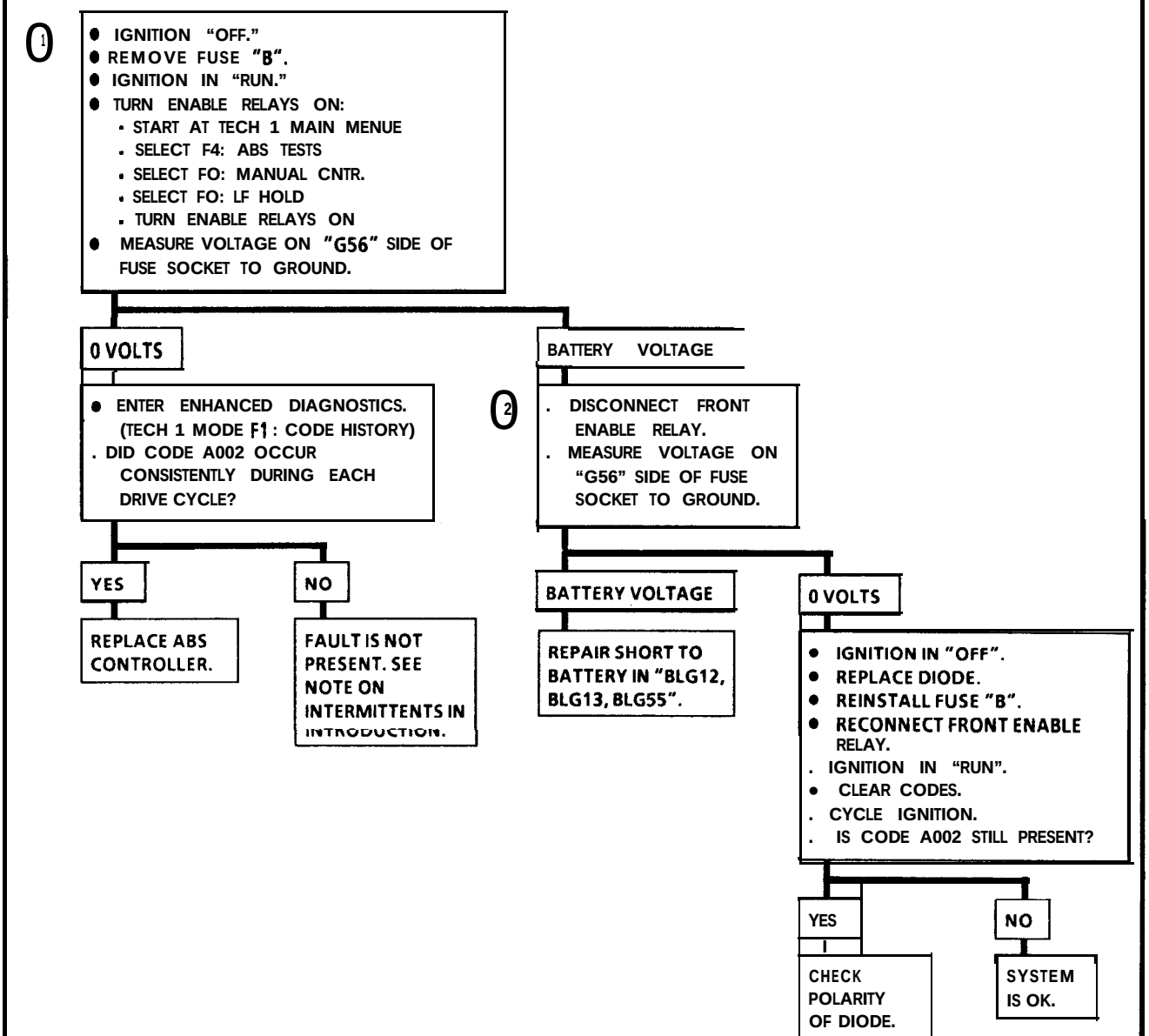
- The Front Enable Relay is energized.
- The ABS Tell Tale Control is closed.
- The ABS Controller senses battery voltage at terminal "Jl-D14".

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

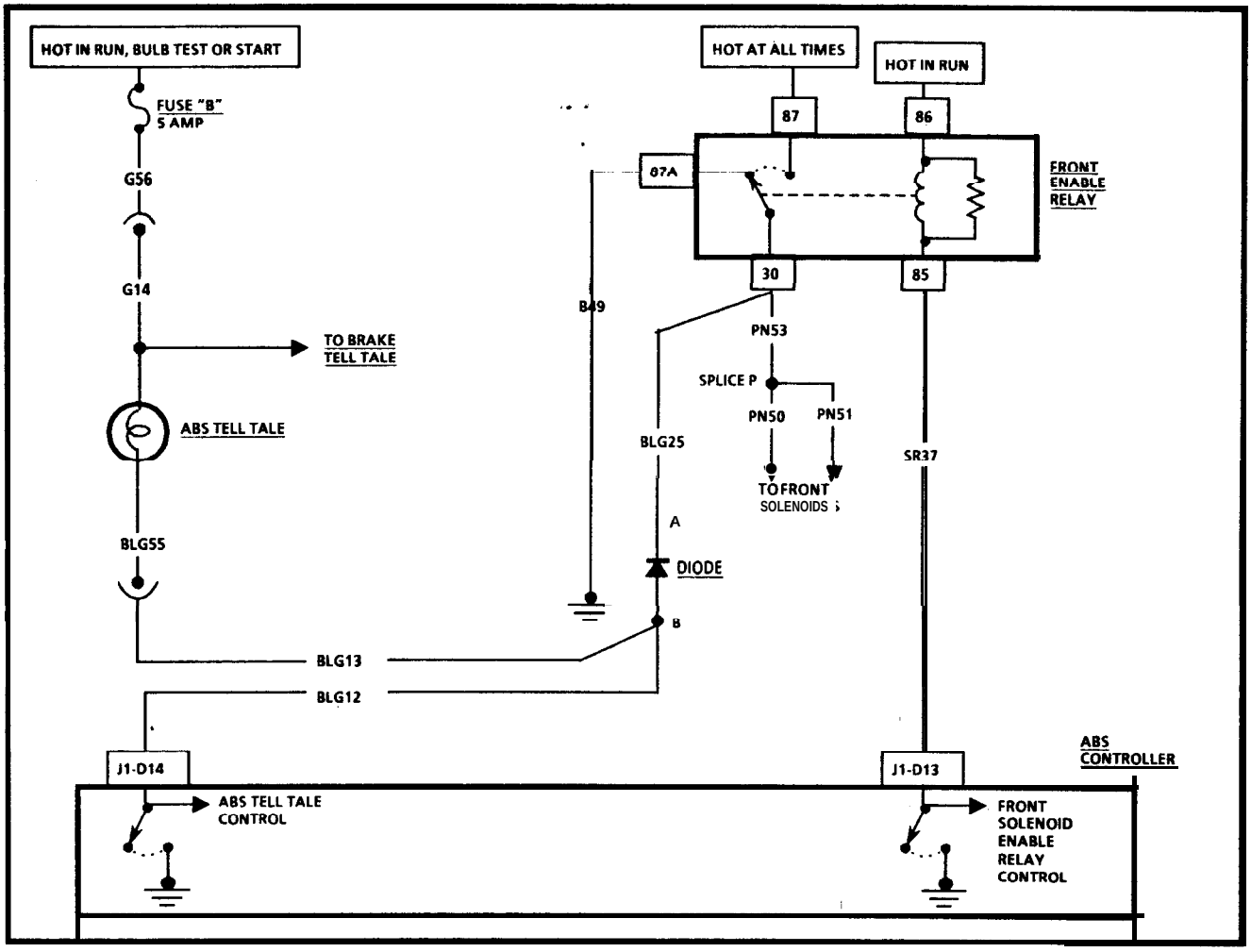
1. Isolates the ABS Tell Tale circuit from its power source and therefore determines whether another voltage source is shorted into the circuit or whether the ABS Controller is defective.
2. Determines whether the Diode is shorted or whether a short to battery exists in "BLG13, BLG12, BLG55".

CODE A002

ABS TELL TALE SHORTED TO BATTERY OR BRAKE DIODE SHORTED


1
• IGNITION "OFF."
• REMOVE FUSE "B".
• IGNITION IN "RUN."
• TURN ENABLE RELAYS ON:
- START AT TECH 1 MAIN MENUE
- SELECT F4: ABS TESTS
- SELECT FO: MANUAL CNTR.
- SELECT FO: LF HOLD
- TURN ENABLE RELAYS ON
• MEASURE VOLTAGE ON "G56" SIDE OF FUSE SOCKET TO GROUND.
0 VOLTS
• ENTER ENHANCED DIAGNOSTICS. (TECH 1 MODE F1 : CODE HISTORY)
. DID CODE A002 OCCUR CONSISTENTLY DURING EACH DRIVE CYCLE?
YES
REPLACE ABS CONTROLLER.
NO
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
BATTERY VOLTAGE
2
. DISCONNECT FRONT ENABLE RELAY.
. MEASURE VOLTAGE ON "G56" SIDE OF FUSE SOCKET TO GROUND.
BATTERY VOLTAGE
REPAIR SHORT TO BATTERY IN "BLG12, BLG13, BLG55".
0 VOLTS
• IGNITION IN "OFF".
• REPLACE DIODE.
• REINSTALL FUSE "B".
• RECONNECT FRONT ENABLE RELAY.
. IGNITION IN "RUN".
• CLEAR CODES.
. CYCLE IGNITION.
. IS CODE A002 STILL PRESENT?
YES
CHECK POLARITY OF DIODE.
NO
SYSTEM IS OK.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE.
WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A003

DIODE OPEN OR GROUND OPEN

If the ABS Controller loses power or ground, the ABS Tell Tale is grounded through "BLG55 and BLG13", the Diode, the open contacts of the Front Enable Relay "30" to "87A" and GND . The Diode prevents Battery Voltage from being applied to the ABS Tell Tale when the Front Enable Relay is energized.

CODE A003 will set during system initialization when all of the following conditions exist:

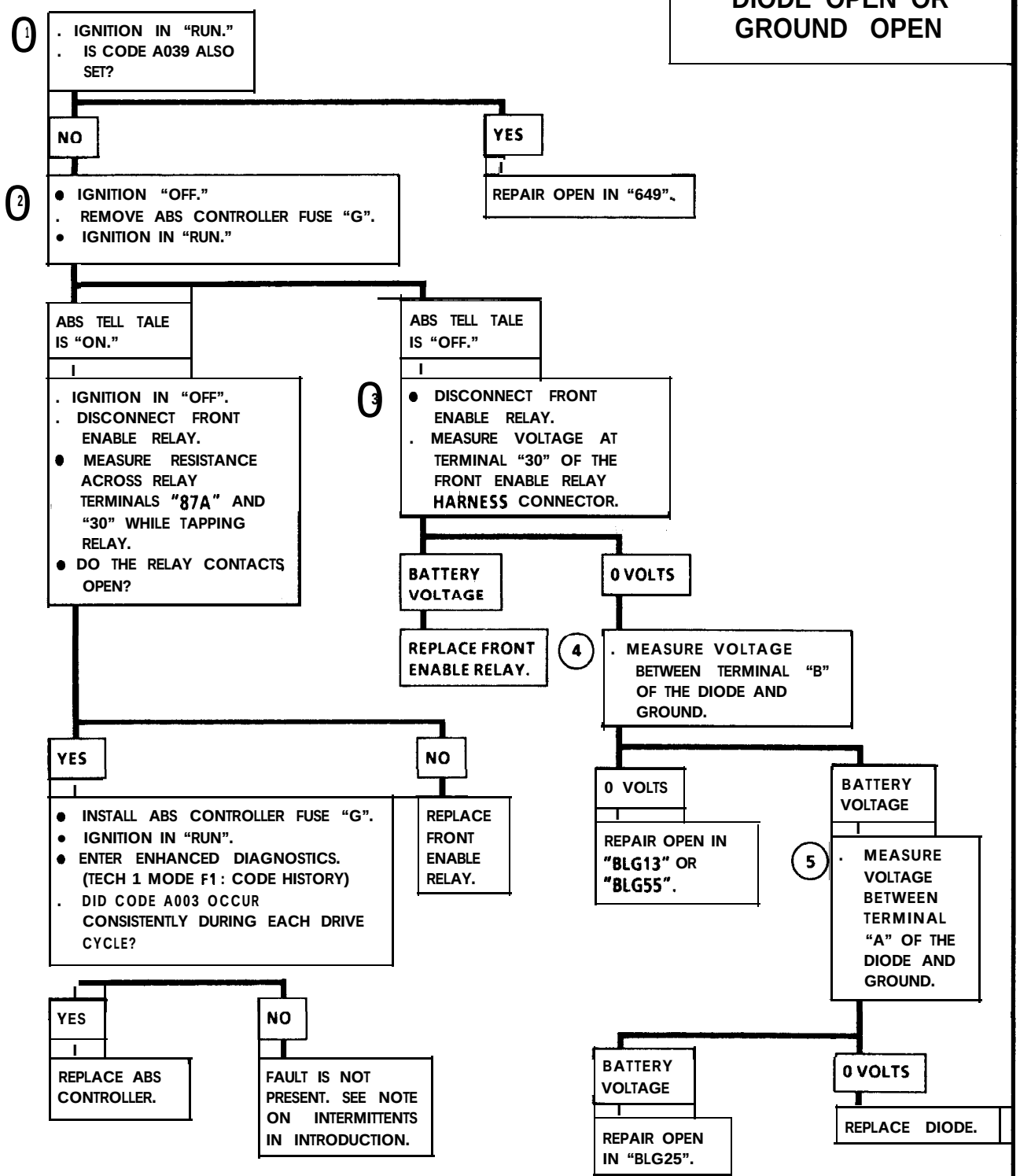
- The Front Enable Relay is deenergized.
- The ABS Tell Tale Control is open.
- The ABS Controller senses battery voltage at terminal "Jl-D14".

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. If code A039 is also set, the connection between relay terminal "87A" and GND must be open.
2. Determines if an open condition exists or if a possible intermittent condition exists.
3. Checks if the open condition exists between ABS Tell Tale and the Front Enable Relay.
4. Indicates if an open condition exists in "BLG13, BLG55" between ABS Tell Tale and the Diode.
5. Determines if an open condition exists in "BLG25" to Front Enable Relay, or in the Diode.

CODE A003

DIODE OPEN OR GROUND OPEN


1
. IGNITION IN "RUN."
. IS CODE A039 ALSO SET?
NO
YES
REPAIR OPEN IN "649".
2
• IGNITION "OFF."
. REMOVE ABS CONTROLLER FUSE "G".
• IGNITION IN "RUN."
ABS TELL TALE IS "ON."
ABS TELL TALE IS "OFF."
. IGNITION IN "OFF".
. DISCONNECT FRONT ENABLE RELAY.
• MEASURE RESISTANCE ACROSS RELAY TERMINALS "87A" AND "30" WHILE TAPPING RELAY.
• DO THE RELAY CONTACTS OPEN?
3
• DISCONNECT FRONT ENABLE RELAY.
. MEASURE VOLTAGE AT TERMINAL "30" OF THE FRONT ENABLE RELAY HARNESS CONNECTOR.
BATTERY VOLTAGE
0 VOLTS
REPLACE FRONT ENABLE RELAY.
4
. MEASURE VOLTAGE BETWEEN TERMINAL "B" OF THE DIODE AND GROUND.
YES
NO
• INSTALL ABS CONTROLLER FUSE "G".
• IGNITION IN "RUN".
• ENTER ENHANCED DIAGNOSTICS. (TECH 1 MODE F1: CODE HISTORY)
. DID CODE A003 OCCUR CONSISTENTLY DURING EACH DRIVE CYCLE?
REPLACE FRONT ENABLE RELAY.
0 VOLTS
BATTERY VOLTAGE
REPAIR OPEN IN "BLG13" OR "BLG55".
5
. MEASURE VOLTAGE BETWEEN TERMINAL "A" OF THE DIODE AND GROUND.
YES
NO
REPLACE ABS CONTROLLER.
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
BATTERY VOLTAGE
0 VOLTS
REPAIR OPEN IN "BLG25".
REPLACE DIODE.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE, WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.

CODE A004

ENABLE RELAY OR SOLENOID FAULT DETECTED

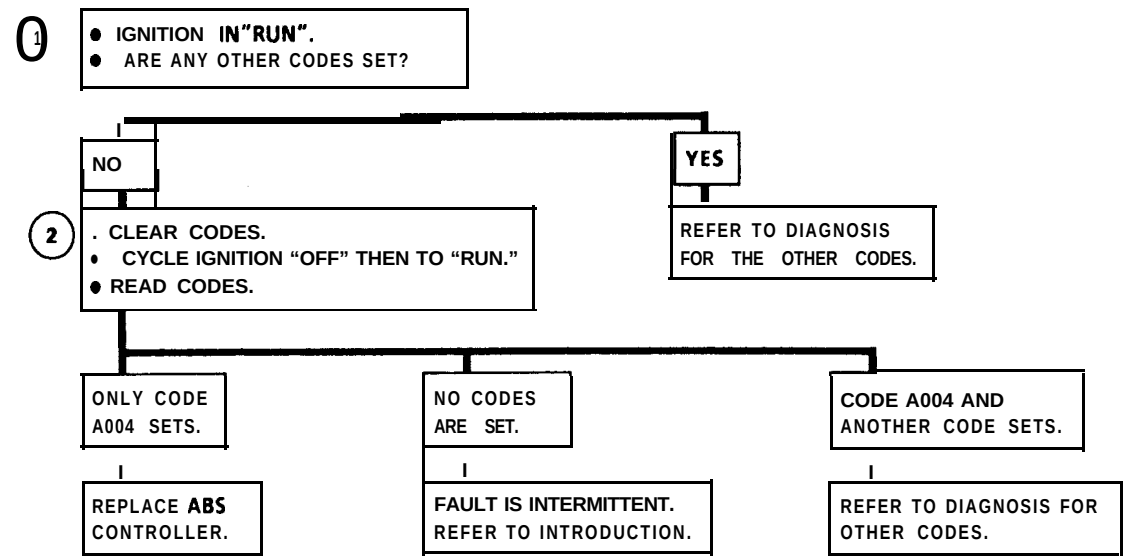
CODE A004 is a pretest which the ABS Controller uses in order to detect that a malfunction has occurred in the solenoid or enable relay circuits. Once the Controller has set Code A004 it will initiate a series of tests in order to pinpoint the malfunction. Code A004 will always set along with another Code. The other code which is set will indicate the nature of the malfunction and where it occurred.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

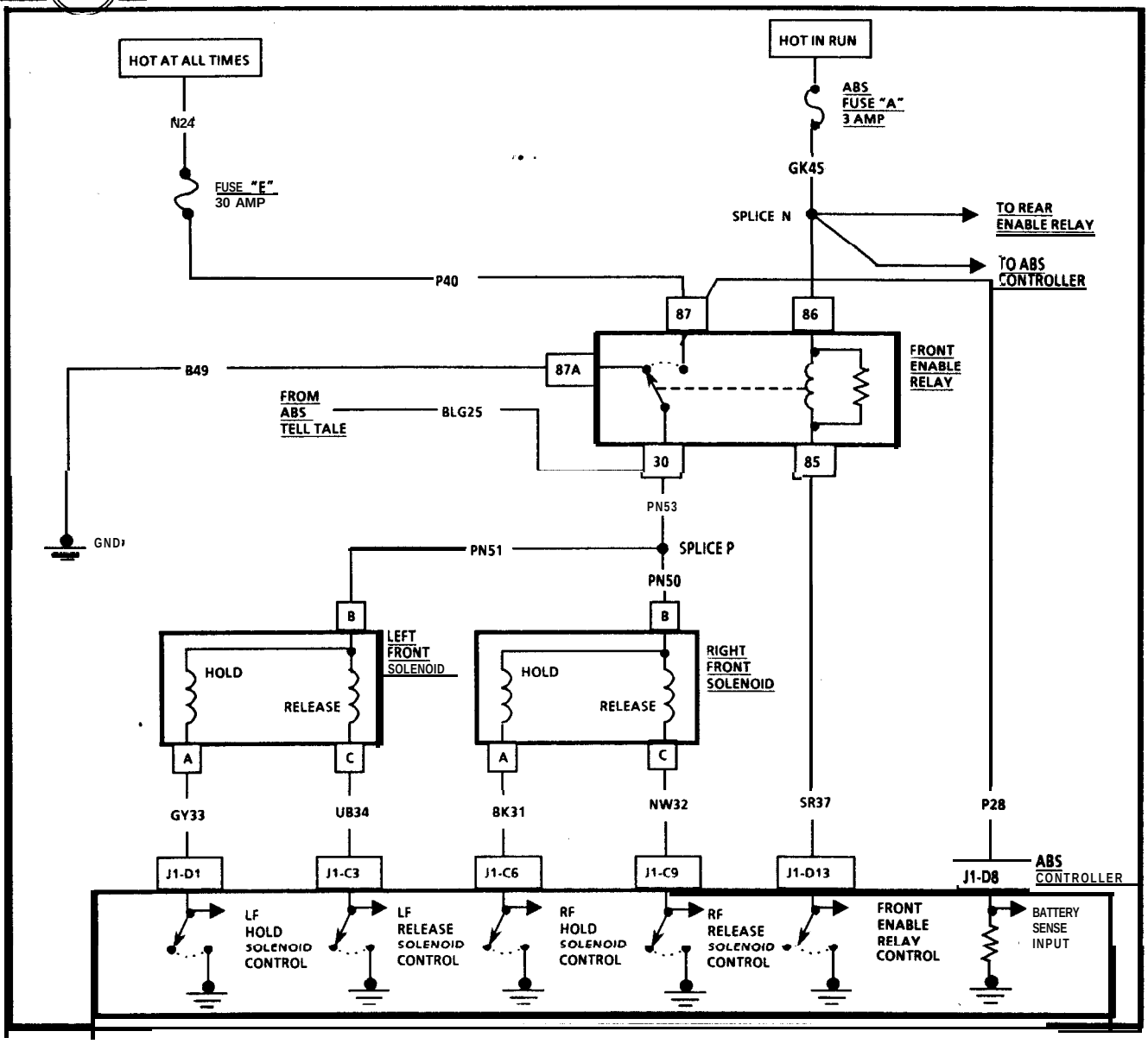
1. If another code is set a fault exists in the solenoid or enable relay circuits. The other code will indicate the nature of the malfunction and where it occurred.
2. If Code A004 sets and no other codes have been set, an internal malfunction in the ABS Controller is indicated.

CODE A004

ENABLE RELAY OR SOLENOID FAULT DETECTED



AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A005

FRONT ENABLE RELAY COIL OPEN, CONTACTS OPEN, FUSE OPEN

If the Ignition is in "RUN" and the ABS Controller does not detect any faults, the Controller will close the Front Enable Relay Control. This grounds the Front Enable Relay Coil and the Relay becomes energized. The contacts close, and voltage is applied from Fuse "E" to the Left Front Solenoid and the Right Front Solenoid. If the ABS Controller is not closing any of the Solenoid Controls, the ABS Controller will sense battery voltage at terminals "Jl-Dl, Jl-C3, Jl-C6, and J1-C9".

CODE A005 will set when all of the following conditions exist:

- The Front Enable Relay Control is closed (Front Enable Relay energized).
- The ABS Controller senses no voltage at terminals "Jl-Dl, Jl-C3, Jl-C6 and J1-C9".

TEST DESCRIPTION: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. If Code A043 is set, refer to code A043.
2. If Code A007 is also set, none of the solenoids are receiving voltage. This indicates a problem in "PN50, PN51", "PN53".
3. If the test lamp lights, it shows that "GK45, SR37", and the ABS Controller are good. This indicates that the fault is in the Front Enable Relay or connector, or the fault is intermittent.
4. This determines if Code A005 was set due to a hard failure or an intermittent condition.
5. If voltage is present at terminal "J1-D13", all external circuits must be good. This indicates an internal problem with the ABS Controller.
6. If voltage is present at Front Enable Relay, but not at terminal "J1-D13", an open in "SR37" is indicated.

CODE A005

FRONT ENABLE RELAY COIL OPEN CONTACTS OPEN, FUSE OPEN

(1) • IGNITION IN "RUN."
• IS CODE A043 ALSO SET?

NO

(2) • IS CODE A007 ALSO SET?

YES

REFER TO CODE A043

NO

(3) • REMOVE FRONT ENABLE RELAY.
• CONNECT A TEST LAMP ACROSS TERMINALS "85" AND "86" OF THE FRONT ENABLE RELAY HARNESS CONNECTOR.
• TURN ENABLE RELAYS ON:
  - START AT TECH 1 MAIN MENUE
  - SELECT F4: ABS TESTS
  - SELECT FO: MANUAL CNTRL
  - SELECT FO: LF HOLD
  - TURN ENABLE RELAYS ON.

YES

CHECK TERMINAL "30" AT THE FRONT E. RELAY AND TERMINAL "B" AT LEFT AND RIGHT FRONT SOLENOID FOR A CLEAN AND TIGHT CONECTION. ALSO, TEST "PN51 ", "PN53" AND "PN50" IF OPEN OR SHORTED TO GROUND.

TEST LAMP DOES NOT LIGHT

(5) . IGNITION "OFF."
• DISCONNECT ABS CONTROLLER. TEST LAMP STILL CONNECTED.
. IGNITION IN "RUN."
• MEASURE VOLTAGE AT TERMINAL "J1-D13" OF ABS CONTROLLER HARNESS CONNECTOR.

TEST LAMP LIGHTS

(4) . ENTER ENHANCED DIAGNOSTICS. (TECH 1 MODE F1 : CODE HISTORY)
. DID CODE A005 OCCUR CONSISTENTLY DURING EACH DRIVE CYCLE?

YES

REPLACE FRONT ENABLE RELAY.

NO

FAULT MAY NOT BE PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.-

0 VOLTS

(6) • DISCONNECT TEST LAMP.
. MEASURE VOLTAGE TO GROUND AT TERMINAL "86" OF FRONT ENABLE RELAY HARNESS CONNECTOR.

1 BATTERY VOLTAGE

CHECK FOR GOOD TERMINAL CONTACT AT ABS CONTROLLER. IF GOOD, REPLACE ABS CONTROLLER.

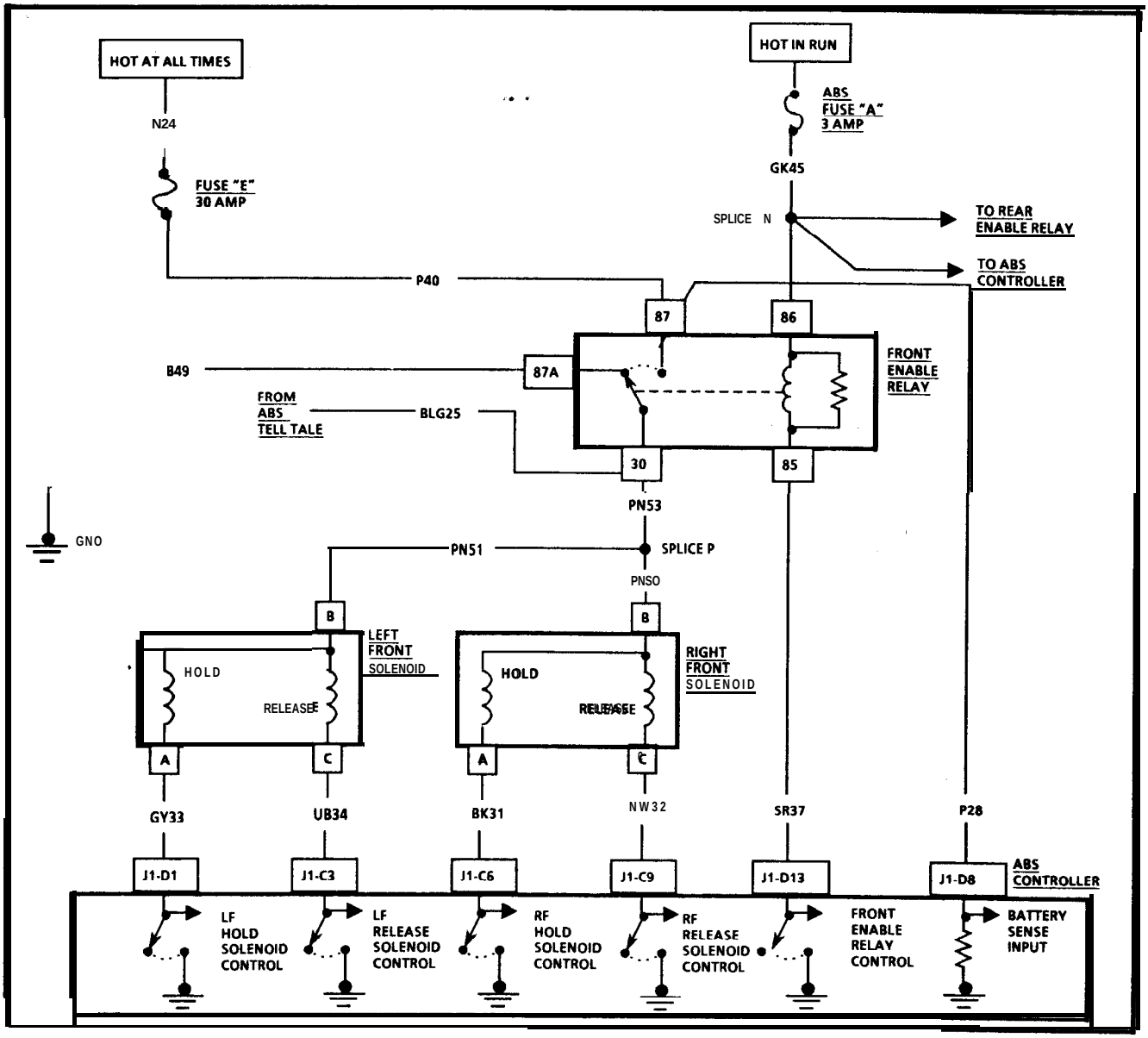
0 VOLTS

REPAIR OPEN "GK45".

BATTERY VOLTAGE

REPAIR OPEN IN "SR37".

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A006

FRONT ENABLE RELAY COIL SHORTED TO BATTERY

Battery Voltage is applied to the Front Enable Relay and "SR37" whenever the Ignition is in "RUN" and the Front Enable Relay Control is open.
When the Front Enable Relay Control is closed, ground is applied to terminal "85" of the Front Enable Relay. "SR37" is now grounded, so voltage is no longer present at terminal "J1-D13" of the ABS Controller. CODE A006 will set when all of the following conditions exist:

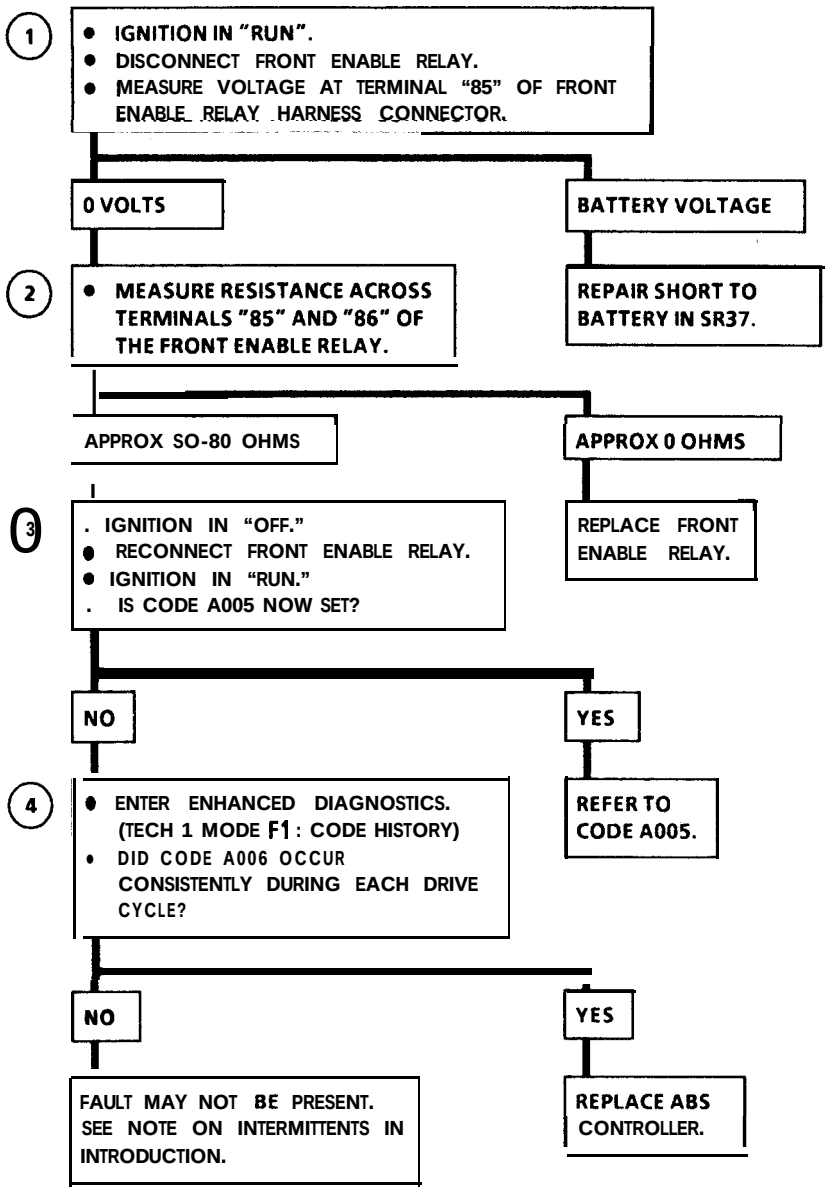
- The Front Enable Relay control is closed (Front Enable Relay energized).
- The ABS Controller senses Battery voltage at Terminal "Jl-D13".
- The ABS Controller senses no voltage at Terminals "J1-D1, Jl-C3, Jl-C6 and J1-C9".

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

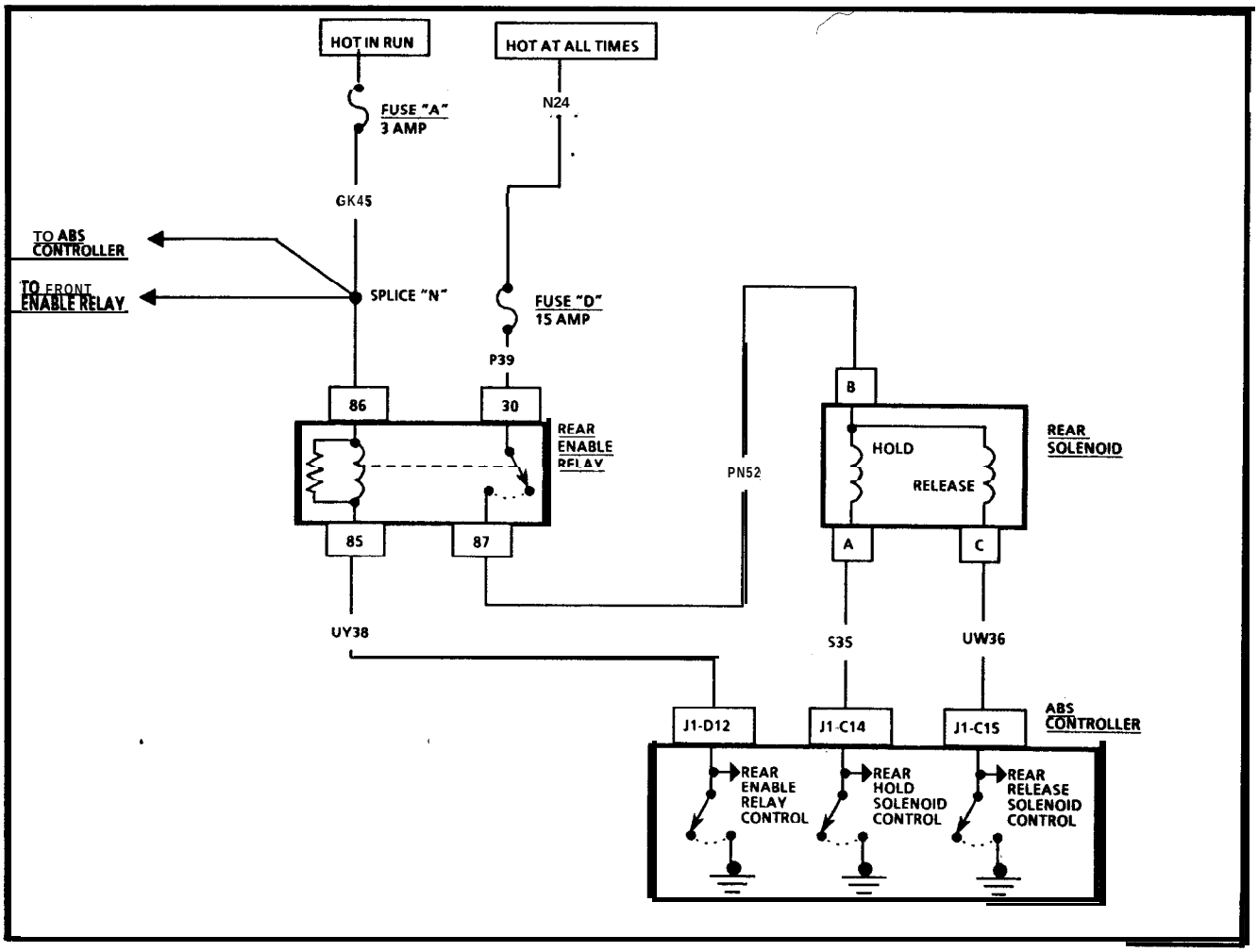
1. With the Front Enable Relay disconnected it can be determined whether a short to Battery exists in "SR37" (Battery voltage present at Terminal "85" of Front Enable Relay connector).
2. Determines if a short exists internally in the Front Enable Relay.
3. It is possible for an open Relay Coil to set this Code. Code A005 will now set if this fault is present.
4. If Code A006 is a consistent failure, the ABS Controller is faulty.

CODE A006

FRONT ENABLE RELAY COIL SHORTED TO BATTERY


1
• IGNITION IN "RUN".
• DISCONNECT FRONT ENABLE RELAY.
• MEASURE VOLTAGE AT TERMINAL "85" OF FRONT ENABLE RELAY HARNESS CONNECTOR.
0 VOLTS
BATTERY VOLTAGE
2
• MEASURE RESISTANCE ACROSS TERMINALS "85" AND "86" OF THE FRONT ENABLE RELAY.
REPAIR SHORT TO BATTERY IN SR37.
APPROX SO-80 OHMS
APPROX 0 OHMS
0
3
. IGNITION IN "OFF."
• RECONNECT FRONT ENABLE RELAY.
• IGNITION IN "RUN."
. IS CODE A005 NOW SET?
REPLACE FRONT ENABLE RELAY.
NO
YES
4
• ENTER ENHANCED DIAGNOSTICS. (TECH 1 MODE F1: CODE HISTORY)
• DID CODE A006 OCCUR CONSISTENTLY DURING EACH DRIVE CYCLE?
REFER TO CODE A005.
NO
YES
FAULT MAY NOT BE PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
REPLACE ABS CONTROLLER.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A007

REAR ENABLE RELAY COIL OPEN, CONTACTS OPEN, FUSE OPEN

If the Ignition is in RUN and the ABS Controller does not detect any faults, the ABS Controller will close the Rear Enable Relay Control. This grounds the Rear Enable Relay and the Relay becomes energized. The contacts close, and voltage is applied from the Fuse "D" to the Rear Solenoid. If the Controller is not closing either of the Rear Solenoid Controls, the ABS Controller will sense **Battery voltage** at terminals **"J1-C14" and "J1-C15"**.

CODE A007 will set when all the following conditions exist:

- The Rear Enable Relay Control is closed (Rear Enable Relay energized).
- The ABS Controller senses no voltage at Terminals "Jl-C14" and "Jl-C15".

Test Description: The following provides an explanation of the procedures being followed in the trouble tree.

1. If Code A005 is also set, none of the Solenoids are receiving voltage. This indicates a problem with PN52.
2. Code A054 will set if the relay coil circuit is open. Diagnostics are covered under code A054.
3. Determines if power feed to Relay contacts is good.
4. If Battery voltage is measured, PN52 and Rear Solenoid are good.
5. Determines if open exists in Rear Solenoid or in PN52, S35, UW36.
6. This determines if Code A007 was set due to a hard failure or an intermittent condition.
7. Checks for short to ground in P39.
8. If test lamp lights, a short to ground in PN52 is indicated.
9. Checks for good power feed to Fuse "D".

CODE A007

REAR ENABLE RELAY COIL OPEN, CONTACTS OPEN, FUSE OPEN

1. • IGNITION IN "RUN."
   • IS CODE A005 ALSO SET?

NO

2. . IS CODE A054 ALSO SET?

YES

CHECK TERMINAL "87" OF REAR ENABLE RELAY AND TERMINAL "8" OF REAR SOLENOID FOR A CLEAN AND TIGHT CONNECTION. ALSO TEST "PN52" FOR OPEN OR SHORTED TO GROUND.

NO

3. • IGNITION IN "OFF".
   • DISCONNECT REAR ENABLE RELAY.
   • IGNITION IN "RUN".
   • MEASURE VOLTAGE TO GROUND AT TERMINAL "30" OF REAR ENABLE RELAY HARNESS CONNECTOR.

YES

REFER TO CODE A054.

0 VOLTS

• CHECK FUSE "D".

FUSE BLOWN

7. • REMOVE BLOWN FUSE.
   . CONNECT TEST LAMP ACROSS FUSE SOCKET TERMINALS.

TEST LAMP DOES NOT LIGHT

TEST LAMP LIGHTS

REPAIR SHORT TO GROUND IN "PN39".

OR

FUSE NOT BLOWN

9. . REMOVE FUSE.
   . MEASURE VOLTAGE AT "N24" SIDE OF FUSE SOCKET.

0 VOLTS

REPAIR OPEN IN "P39".

BATTERY VOLTAGE

REPAIR OPEN IN "N24" BETWEEN BATTERY AND FUSE "D".

BATTERY VOLTAGE

4. . CONNECT TEST LAMP ACROSS TERMINALS "87" AND "30" OF REAR ENABLE RELAY HARNESS CONNECTOR.
   • TURN REAR HOLD SOLENOID "ON" AND ENABLE RELAYS "OFF"
   - START AT TECH 1 MAIN MENUE
   - SELECT F4: ABS TESTS
   - SELECT FO: MANUAL CNTRL
   - SELECT F2: RER HOLD
   - TURN CMD STATE:ON
     TURN ENAB RELAYS:OFF

TEST LAMP LIGHTS

6. • ENTER ENHANCED DIAGNOSTICS. (TECH 1 MODE F1 : CODE HISTORY).
   . DID CODE A007 OCCUR CONSISTENTLY DURING EACH DRIVE CYCLE?

YES

REPLACE REAR ENABLE RELAY.

OR

TEST LAMP DOES NOT LIGHT

5. . IGNITION IN "OFF"
   • DISCONN. REAR SOL.
   • MEASURE RESISTANCE ACROSS TERMINALS "8" AND "C" AND "8" AND "A" OF REAR SOL.

APPROX 3 OHMS

REPAIR OPEN IN "PN52" OR IN BOTH CKT "S35 AND "UW36".

INFINITE OHMS

REPLACE REAR SOLENOID.

NO

FAULT MAY NOT BE PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

OR

8. • INSTALL REAR ENABLE RELAY
   . CONNECT TEST LAMP ACROSS FUSE "D" SOCKET TERMINALS.
   . DISCONNECT REAR SOLENOID
   . TURN ENABLE RELAYS ON:
   - START AT TECH 1 MAIN MENUE
   - SELECT F4: ABS TESTS
   - SELECT FO: MANUAL CNTRL
   - SELECT FO: LF HOLD
   - TURN ENAB RELAYS ON.

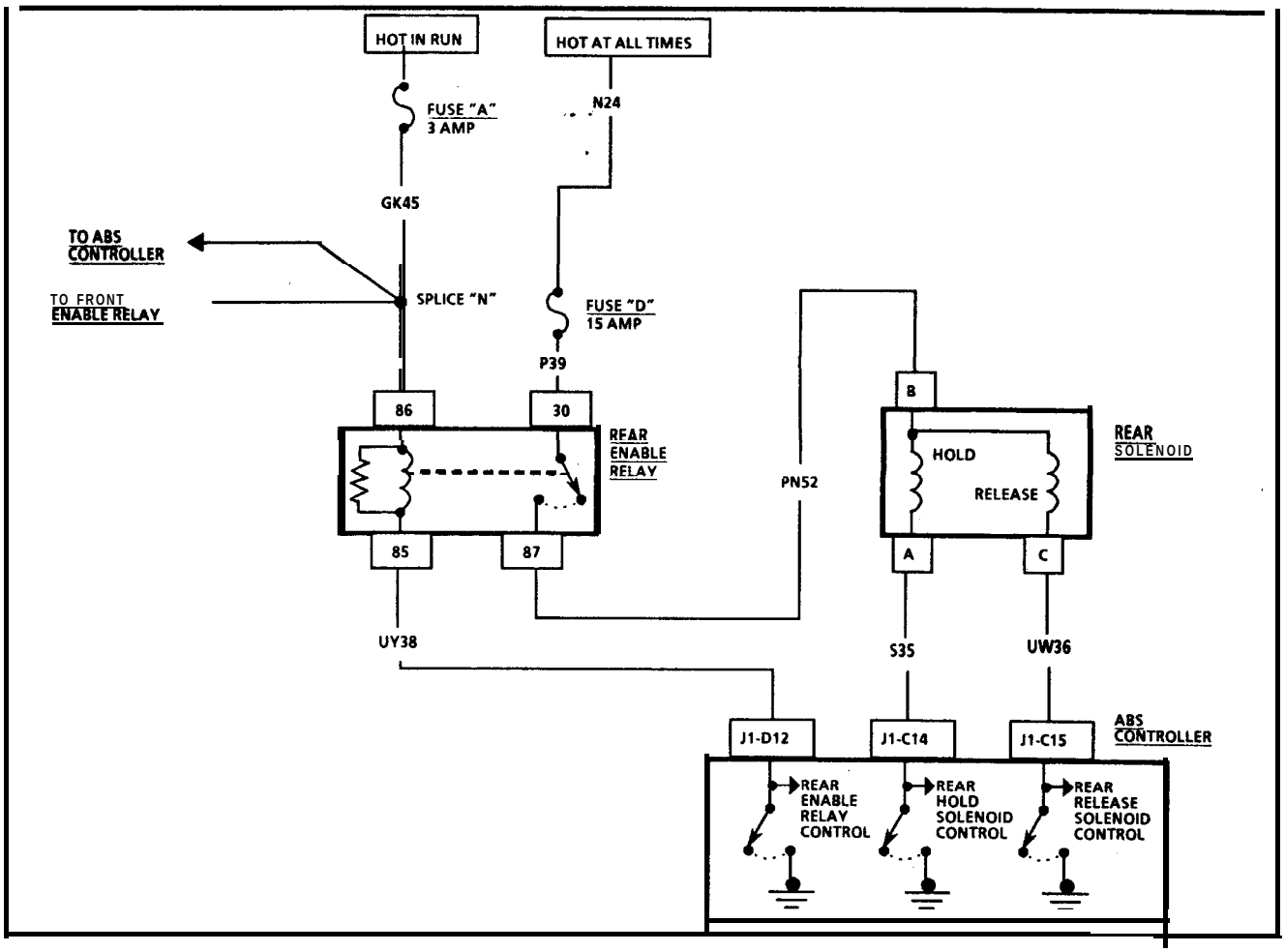
TEST LAMP DOES NOT LIGHT

REPLACE FUSE. SYSTEM IS OK.

TEST LAMP LIGHTS

REPAIR SHORT TO GROUND IN "PN52".

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A008

REAR ENABLE RELAY COIL SHORTED TO BATTERY

Battery voltage is applied to the Rear Enable Relay and UY38 whenever the Ignition is in RUN and the Rear Enable Relay Control is open. When the Rear Enable Relay Control is closed, ground is applied to terminal "85" of the Rear Enable Relay. UY38 is now grounded, so voltage is no longer present at terminal "J1-D12" of the ABS Controller.

CODE A008 will set when all the following conditions exist:

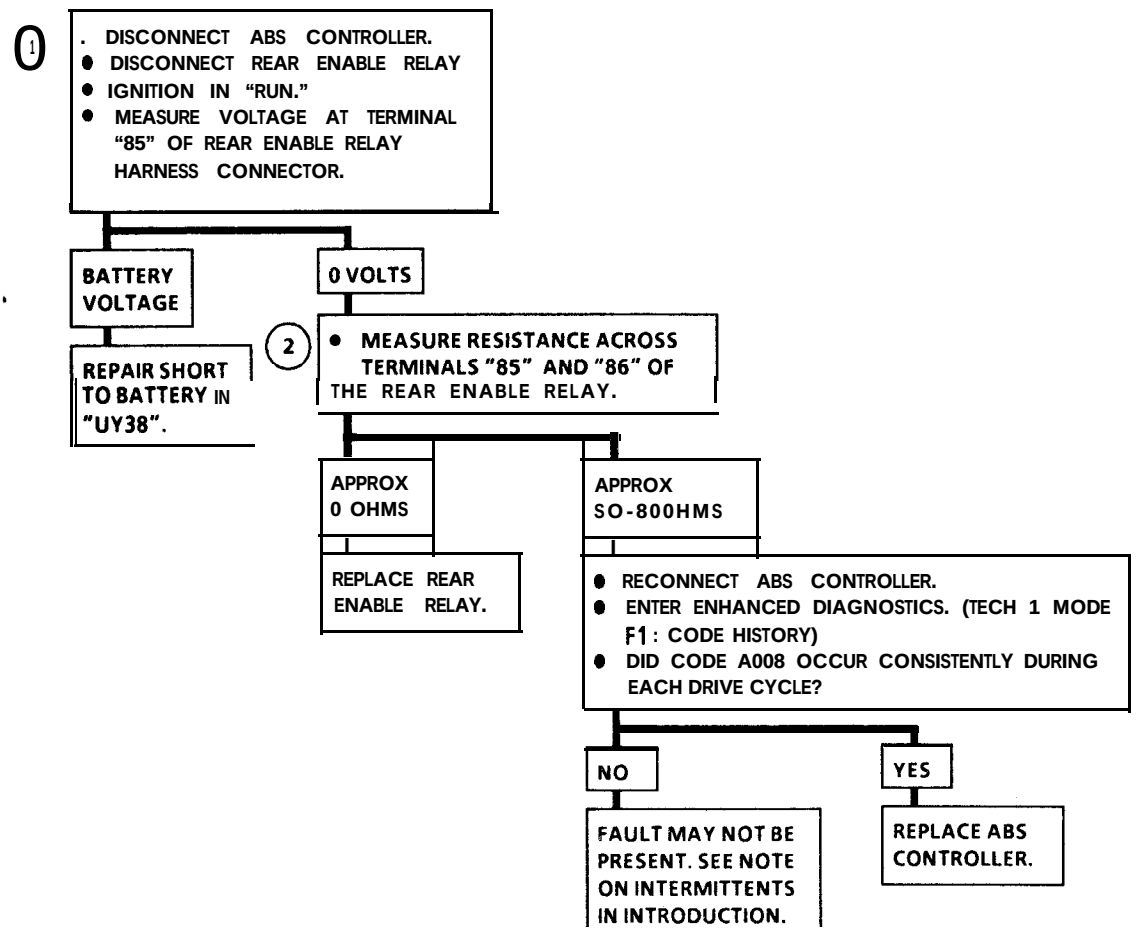
- The Rear Enable Relay Control is closed (Rear Enable Relay energized).
- The ABS Controller senses Battery voltage at Terminal "Jl-D12".
- The ABS Controller senses no voltage at Terminals "J1-C14" and "J1-C15".

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

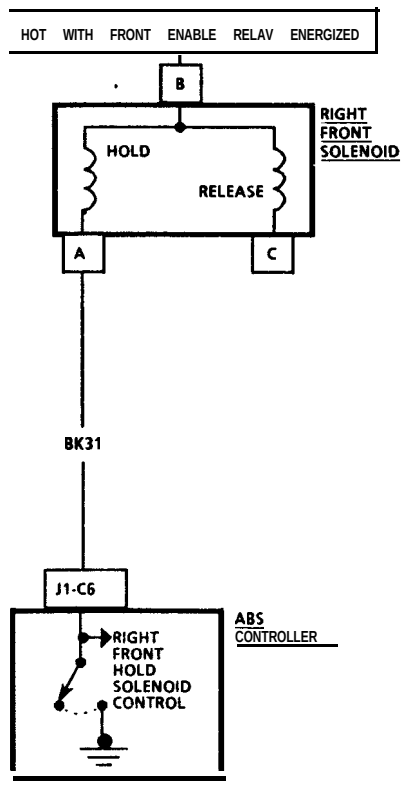
1. With the Rear Enable Relay disconnected it can be determined whether a short to Battery exists in the UY38 (Battery voltage present at Terminal "85" of Rear Enable Relay harness connector).
2. Determines if a short exists internally in the Rear Enable Relay or whether the ABS Controller is defective.

CODE A008

REAR ENABLE RELAY COIL SHORTED TO BATTERY


0
1
. DISCONNECT ABS CONTROLLER.
• DISCONNECT REAR ENABLE RELAY
• IGNITION IN "RUN."
• MEASURE VOLTAGE AT TERMINAL "85" OF REAR ENABLE RELAY HARNESS CONNECTOR.
BATTERY VOLTAGE
REPAIR SHORT TO BATTERY IN "UY38".
0 VOLTS
2
• MEASURE RESISTANCE ACROSS TERMINALS "85" AND "86" OF THE REAR ENABLE RELAY.
APPROX 0 OHMS
REPLACE REAR ENABLE RELAY.
APPROX SO-800HMS
• RECONNECT ABS CONTROLLER.
• ENTER ENHANCED DIAGNOSTICS. (TECH 1 MODE F1: CODE HISTORY)
• DID CODE A008 OCCUR CONSISTENTLY DURING EACH DRIVE CYCLE?
NO
FAULT MAY NOT BE PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
YES
REPLACE ABS CONTROLLER.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEARCODES AND VERIFY OPERATION.



CODE A009

RIGHT FRONT HOLD SOLENOID OPEN OR SHORTED TO GROUND

When the Front Enable Relay is energized, voltage is applied to the Right Front, Solenoid. If the ABS Controller determines that the Right Front Hold Solenoid should be activated, it will close the Right Front Hold Solenoid Control. Ground is now applied at terminal A of the Right Front Solenoid, so the Right Front Hold Solenoid is on.

CODE A009 will set when all the following conditions exist:

- The Front Enable Relay is energized.
- The Right Front Hold Solenoid control is open.
- The ABS Controller senses no voltage at terminal "Jl-C6".

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. If Code A012 is also set, the power feed to the Right Front Solenoid is open.
2. Voltage at terminal **"J1-C6"** will cause the TECH 1 to display a HIG feedback. A LOW feedback indicates that voltage is not present.
3. A short to ground must be present if the test lamp lights.
4. If short to ground does not exist with Controller disconnected, short is internal to Controller.
5. PN50, PN53 is OK if the test lamp lights. Open must be internal to solenoid.
6. If continuity to ground through the Front Enable Relay contacts is present, open must be internal to Controller.
7. Determines if open is in Solenoid or **"BK31"**.

CODE A009

RIGHT FRONT HOLD SOLENOID OPEN OR SHORTED TO GROUND

1. ● IGNITION IN "RUN."
   ● IS CODE A012 ALSO SET?

NO

2. ● TURN RIGHT FRONT HOLD SOLENOID "OFF" AND ENABLE RELAYS "ON":
   - START AT TECH 1 MAIN MENUE
   - SELECT F4: ABS TESTS
   - SELECT FO: MANUAL CNTRL
   - SELECT F1 : RF HOLD
   - TURN CMD STATE: OFF
   - TURN ENAB RELAY: ON

FEEDBACK STATE LOW

3. ● IGNITION IN "OFF".
   ● DISCONNECT RIGHT FRONT SOLENOID.
   ● IGNITION IN "RUN".
   ● CONNECT TEST LAMP BETWEEN TERMINALS B AND A OF RIGHT FRONT SOLENOID HARNESS CONNECTOR.
   ● TURN ENABLE RELAYS "ON", AND RF HOLD SOL. "OFF" (SEE ②).

TEST LAMP DOES NOT LIGHT

6. ● IGNITION IN "OFF".
   ● RECONNECT RIGHT FRONT SOLENOID.
   ● DISCONNECT ABS CONTROLLER.
   ● MEASURE RESISTANCE FROM TERMINAL "J1-C6" OF ABS CONTROLLER HARNESS CONNECTOR TO GROUND.

INFINITE OHM5

7. ● DISCONNECT RIGHT FRONT SOLENOID.
   ● MEASURE RESISTANCE BETWEEN TERMINALS "A" AND "B" OF RIGHT FRONT SOLENOID.

APPROX 3 OHM5

REPAIR OPEN IN "BK31".

10 OHM5 OR LESS

CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER. IF CONTACT I5 GOOD, REPLACE ABS CONTROLLER.

INFINITE OHMS

REPLACE RIGHT FRONT SOLENOID.

FEEDBACK STATE HIGH

FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENT5 IN INTRODUCTION.

YES

5. ● DISCONNECT RIGHT FRONT SOLENOID.
   ● CONNECT TEST LAMP BETWEEN TERMINAL B OF RIGHT FRONT SOLENOID HARNESS CONNECTOR AND GROUND.
   ● TURN ENABLE RELAYS "ON" (SEE ②.)

TEST LAMP DOES NOT LIGHT

REPAIR OPEN IN "PN50, PN53" BETWEEN RIGHT FRONT SOLENOID AND FRONT ENABLE RELAY.

TEST LAMP LIGHTS

REPLACE RIGHT FRONT SOLENOID.

TEST LAMP LIGHTS

4. ● IGNITION IN "OFF".
   ● DISCONNECT ABS CONTROLLER AND TEST LAMP.
   ● MEASURE RESISTANCE FROM TERMINAL "J1-C6" OF ABS CONTROLLER HARNESS CONNECTOR TO GROUND.

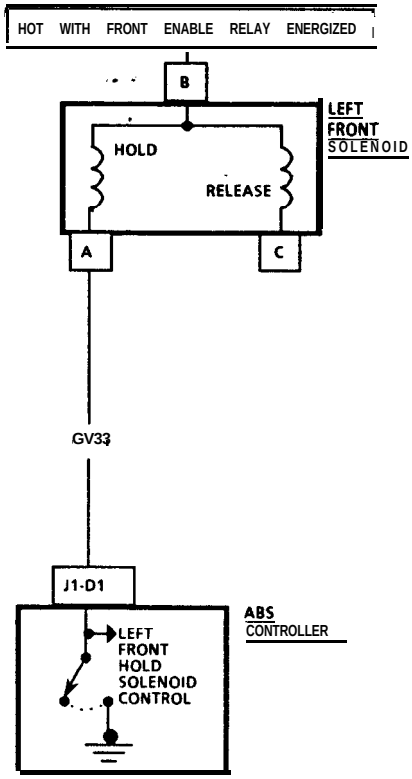
INFINITE OHMS

REPLACE ABS CONTROLLER.

10 OHM5 OR LESS

REPAIR SHORT TO GROUND IN "BK31".

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODE5 AND VERIFY OPERATION.



CODE **A010**

LEFT FRONT HOLD SOLENOID OPEN OR SHORTED TO GROUND

When the Front Enable Relay is energized, voltage is applied to the Left Front Solenoid. If the ABS Controller determines that the Left Front Hold Solenoid should be activated, it will close the Left Front Hold Solenoid Control. Ground is now applied at terminal A of the Left Front Solenoid, so the Left Front Hold Solenoid is on.

CODE A010 will set when all the following conditions exist:

- The Front Enable Relay is energized.
- The Left Front Hold Solenoid Control is open.
- The ABS Controller senses no voltage at Terminal **"Jl-Dl".**

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. If Code A013 is also set, the power feed to the Left Front Solenoid is open.
2. Voltage at terminal "Jl-Dl" will cause the TECH 1 to display a HIG feedback. A LOW feedback indicates that voltage is not present.
3. A short to ground must be present if the test lamp lights.
4. If short to ground does not exist with controller disconnected, short is internal to Controller.
5. PN51, PN53 is OK if the test lamp lights. Open must be internal to solenoid.
6. If continuity to ground through the Front Enable Relay Contacts is present, open must be internal to Controller.
7. Determines if open is in solenoid or "GY33".

CODE A01 0

LEFT FRONT HOLD SOLENOID OPEN OR SHORTED TO GROUND

(1) • IGNITION IN "RUN."
• IS CODE A013 ALSO SET?

- NO
- YES

(2) • TURN LEFT FRONT HOLD SOLENOID "OFF" AND ENABLE RELAYS "ON":
• START AT TECH 1 MAIN MENUE
• SELECT F4: ABS TESTS
• SELECT FO: MANUAL CNTRL
• SELECT FO: LF HOLD
• TURN CMD STATE: OFF
• TURN ENAB RELAYS: ON

- TEST LAMP DOES NOT LIGHT → REPAIR OPEN IN "PN51, PN53" BETWEEN LEFT FRONT SOLENOID AND FRONT ENABLE RELAY.
- TEST LAMP LIGHTS → REPLACE LEFT FRONT SOLENOID.

(5) . DISCONNECT LEFT FRONT SOLENOID.
. CONNECT TEST LAMP BETWEEN TERMINAL "B" OF LEFT FRONT SOLENOID HARNESS CONNECTOR AND GROUND.
. TURN ENABLE RELAYS "ON." (SEE ②).

- FEEDBACK STATE LOW
- FEEDBACK STATE HIGH → FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

(3) . IGNITION IN "OFF".
• DISCONNECT LEFT FRONT SOLENOID.
• IGNITION IN "RUN".
• CONNECT TEST LAMP BETWEEN TERMINALS "B" AND "A" OF LEFT FRONT SOLENOID HARNESS CONNECTOR.
• TURN ENABLE RELAYS "ON" AND LF HOLD SOLENOID "OFF" (SEE ②).

- TEST LAMP DOES NOT LIGHT
- TEST LAMP LIGHTS

(6) • IGNITION IN "OFF".
• RECONNECT LEFT FRONT SOLENOID.
• DISCONNECT ABS CONTROLLER.
• MEASURE RESISTANCE FROM TERMINAL "J1-D1 " OF ABS CONTROLLER HARNESS CONNECTOR TO GROUND.

- INFINITE OHMS
- 10 OHMS OR LESS → CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER. IF CONTACT IS GOOD, REPLACE ABS CONTROLLER.

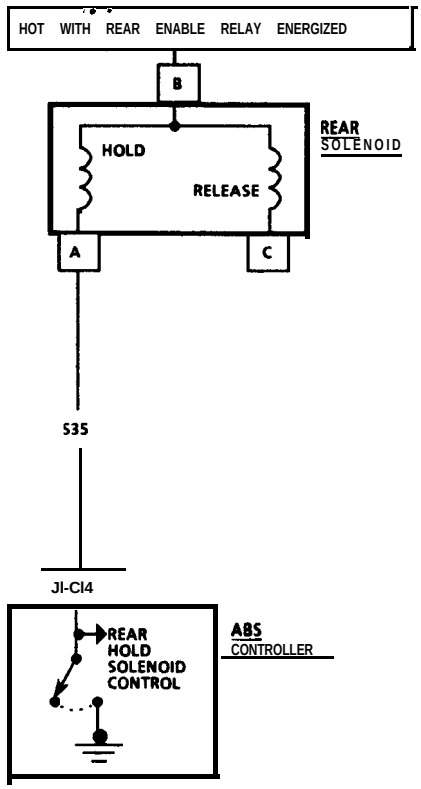
(7) • DISCONNECT LEFT FRONT SOLENOID.
. MEASURE RESISTANCE BETWEEN TERMINALS "A" AND "B" OF LEFT FRONT SOLENOID.

- APPROX 3 OHMS → REPAIR OPEN IN "GY33".
- INFINITE OHMS → REPLACE LEFT FRONT SOLENOID.

(4) . IGNITION IN "OFF".
. DISCONNECT ABS CONTROLLER AND TEST LAMP.
. MEASURE RESISTANCE FROM TERMINAL "J1-D1" OF ABS CONTROLLER HARNESS CONNECTOR TO GROUND.

- INFINITE OHMS → REPLACE ABS CONTROLLER.
- 10 OHMS OR LESS → REPAIR SHORT TO GROUND IN "GY33".

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A01 1

REAR HOLD SOLENOID OPEN OR SHORTED TO GROUND

When the Rear Enable Relay is energized, voltage is applied to the Rear Solenoid. If the ABS Controller determines that the Rear Hold Solenoid should be activated, it will close the Rear Hold Solenoid Control. Ground is now applied at terminal A of the Rear Solenoid, so the Rear Hold Solenoid is on.
CODE A01 1 will set when all the following conditions exist:

- The Rear Enable Relay is energized.
- The Rear Hold Solenoid Control is open.
- The ABS Controller senses no voltage at Terminal "Jl-C14".

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. If Code A014 is also set, the power feed to the Rear Solenoid is open.
2. Voltage at terminal **"J1-C14"** will cause the TECH 1 to display a HIG feedback. A LOW feedback indicates that voltage is not present.
3. A short to ground must be present if the test lamp lights.
4. If short to ground does not exist with ABS Controller disconnected, short is internal to ABS Controller.
5. PN52 is OK if the test lamp lights. Open must be internal to solenoid.
6. If test lamp lights, Rear Hold Solenoid and **S35** are good. Open must be internal to ABS Controller.
7. Determines if open is in Solenoid or S35.

CODE A01 1

REAR HOLD SOLENOID OPEN OR SHORTED TO GROUND

(1) ● IGNITION IN "RUN."
● IS CODE A014 ALSO SET?

NO

(2) ● TURN REAR HOLD SOLENOID "OFF" AND ENABLE RELAYS "ON":
- START AT TECH 1 MAIN MENUE
- SELECT F4: ABS TESTS
- SELECT FO: MANUAL CNTRL
- SELECT F2: RER HOLD
- TURN CMD STATE: OFF
- TURN ENAB RELAYS: ON

FEEDBACK STATE LOW

(33) ● IGNITION IN "OFF".
● DISCONNECT REAR SOLENOID.
IGNITION IN "RUN".
. CONNECT TEST LAMP BETWEEN TERMINALS "B" AND "A" OF REAR SOLENOID HARNESS CONNECTOR.
● TURN ENABLE RELAYS "ON" AND REAR HOLD SOLENOID "OFF" (SEE ②).

TEST LAMP DOES NOT LIGHT

(36) ● IGNITION IN "OFF".
. RECONNECT REAR SOLENOID
● DISCONNECT ABS CONTROLLER.
● DISCONNECT REAR ENABLE RELAY.
● CONNECT A FUSED JUMPER BETWEEN TERMINALS "87" AND "30" OF REAR ENABLE RELAY HARNESS CONNECTOR.
• CONNECT TEST LAMP TO GROUND AT TERMINAL "J1-C14" OF ABS CONTROLLER HARNESS CONNECTOR.
. IGNITION IN "RUN".

(7) TEST LAMP DOES NOT LIGHT

● IGNITION IN "OFF".
● DISCONNECT REAR SOLENOID.
• MEASURE RESISTANCE BETWEEN TERMINALS "A" AND "B" OF REAR SOLENOID.

APPROX 3 OHMS

REPAIR OPEN IN "S35".

INFINITE OHMS

REPLACE REAR SOLENOID.

TEST LAMP LIGHTS

(4) ● IGNITION IN "OFF".
. DISCONNECT ABS CONTROLLER AND TEST LAMP.
● MEASURE RESISTANCE FROM TERMINAL "J1-C14" OF ABS CONTROLLER HARNESS CONNECTOR TO GROUND.

INFINITE OHMS

REPLACE ABS CONTROLLER.

10 OHM5 OR LESS

REPAIR SHORT TO GROUND IN "S35".

TEST LAMP LIGHTS

CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER. IF CONTACT IS GOOD, REPLACE ABS CONTROLLER.

YES

(5) ● DISCONNECT REAR SOLENOID.
● CONNECT TEST LAMP BETWEEN TERMINAL "B" OF REAR SOLENOID HARNESS CONNECTOR AND GROUND.
. TURN ENABLE RELAYS "ON." (SEE ②).

TEST LAMP DOES NOT LIGHT

REPAIR OPEN IN "PN52" BETWEEN REAR SOLENOID AND REAR ENABLE RELAY.

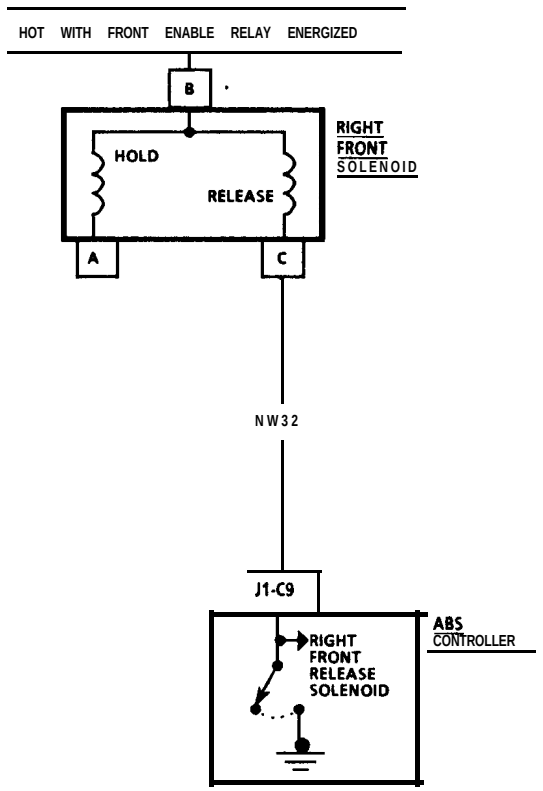
TEST LAMP LIGHTS

REPLACE REAR SOLENOID.

FEEDBACK STATE HIGH

FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A01 2

RIGHT FRONT RELEASE SOLENOID OPEN OR SHORTED TO GROUND

When the Front Enable Relay is energized, voltage is applied to the Right Front Solenoid. If the ABS Controller determines that the Right Front Release Solenoid should be activated, it will close the Right Front Release Solenoid Control. Ground is now applied at terminal C of the Right Front Solenoid, so the Right Front Release Solenoid is on.

CODE A012 will set when all the following conditions exist:

- The Front Enable Relay is energized.
- The Right Front Release Solenoid Control is open
- The ABS Controller senses no voltage at Terminal "J1-C9".

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. If Code A009 is also set, the power feed to the Right Front Solenoid is open.
2. Voltage at terminal "J1-C9" will cause the TECH 1 to display a HIG feedback. A LOW feedback indicates that voltage is not present.
3. A short to ground must be present if the test lamp lights.
4. If short to ground does not exist with ABS Controller disconnected, short is internal to ABS Controller.
5. PN50, PN53 is OK, if the test lamp lights. Open must be internal to solenoid.
6. If continuity to ground through the Front Enable Relay is present, open must be internal to ABS Controller.
7. Determines if open is in Solenoid or NW32.

CODE A012

RIGHT FRONT RELEASE SOLENOID OPEN OR SHORTED TO GROUND

1 • IGNITION IN "RUN."
• IS CODE A009 ALSO SET?

NO

2 • TURN RIGHT FRONT RELEASE SOLENOID "OFF" AND ENABLE RELAYS "ON":
- START AT TECH 1 MAIN MENUE
- SELECT F4: ABS TESTS
- SELECT FO: MANUAL CNTRL
- SELECT F5: RF RELEASE
- TURN CMD STATE: OFF
- TURN ENAB RELAYS: ON

YES

5 . DISCONNECT RIGHT FRONT SOLENOID.
. CONNECT TEST LAMP BETWEEN TERMINAL "B" OF RIGHT FRONT SOLENOID HARNESS CONNECTOR AND GROUND.
• TURN ENABLE RELAYS "ON" (SEE ②).

TEST LAMP DOES NOT LIGHT

REPAIR OPEN IN "PN50, PN53" BETWEEN RIGHT FRONT SOLENOID AND FRONT ENABLE RELAY.

TEST LAMP LIGHTS

REPLACE RIGHT FRONT SOLENOID.

FEEDBACK STATE LOW

3 • IGNITION IN "OFF".
• DISCONNECT RIGHT FRONT SOLENOID.
• IGNITION IN "RUN".
• CONNECT TEST LAMP BETWEEN TERMINALS "B" AND "C" OF RIGHT FRONT SOLENOID HARNESS CONNECTOR.
• TURN ENABLE RELAYS "ON" AND RF RELEASE SOLENOID "OFF" (SEE ②).

FEEDBACK STATE HIGH

FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENT5 IN INTRODUCTION.

TEST LAMP DOES NOT LIGHT

6 • IGNITION IN "OFF".
• RECONNECT RIGHT FRONT SOLENOID.
• DISCONNECT ABS CONTROLLER.
• MEASURE RESISTANCE FROM TERMINAL "J1-C9" OF ABS CONTROLLER HARNESS CONNECTOR TO GROUND.

TEST LAMP LIGHTS

4 • IGNITION IN "OFF".
. DISCONNECT ABS CONTROLLER AND TEST LAMP.
. MEASURE RESISTANCE FROM TERMINAL "J1-C9" OF ABS CONTROLLER HARNESS CONNECTOR TO GROUND.

INFINITE OHMS

7 • DISCONNECT RIGHT FRONT SOLENOID.
• MEASURE RESISTANCE BETWEEN TERMINALS "C" AND "B" OF RIGHT FRONT SOLENOID.

10 OHMS OR LESS

CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER. IF CONTACT IS GOOD, REPLACE ABS CONTROLLER.

APPROX 3 OHMS

REPAIR OPEN IN "NW32".

INFINITE OHM5

REPLACE RIGHT FRONT SOLENOID.

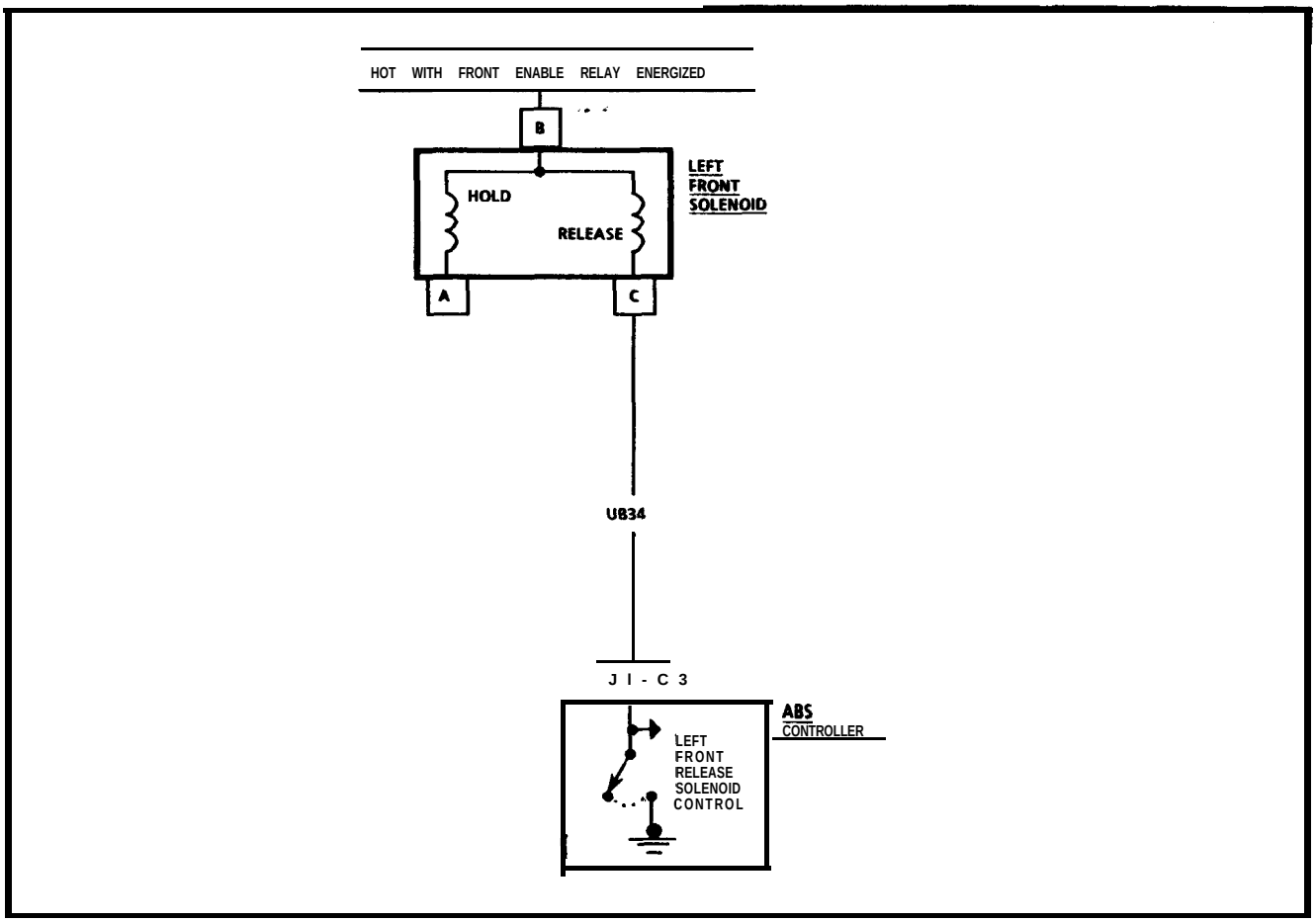
INFINITE OHMS

REPLACE ABS CONTROLLER.

10 OHMS OR LESS

REPAIR SHORT TO GROUND IN "NW32".

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A01 3

LEFT FRONT RELEASE SOLENOID OPEN OR SHORTED TO GROUND

When the Front Enable Relay is energized, voltage is applied to the Left Front Solenoid. If the ABS Controller determines that the Left Front Release Solenoid should be activated, it will close the Left Front Release Solenoid Control. Ground is now applied at terminal C of the Left Front Solenoid, so the Left Front Release Solenoid is on.

CODE A013 will set when all the following conditions exist:

- The Front Enable Relay is energized.
- The Left Front Release Solenoid Control is open.
- The ABS Controller senses no voltage at Terminal **"J1-C3".**

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. If Code A010 is also set, the power feed to the Left Front Solenoid is open.
2. Voltage at terminal **"J1-C3"** will cause the TECH 1 to display a HIG feedback. A LOW feedback indicates that voltage is not present.
3. A short to ground must be present if the test lamp lights.
4. If short to ground does not exist with controller disconnected, short is internal to controller.
5. PN51, PN53 is OK **if the** test lamp lights. Open must be internal to solenoid.
6. If continuity to ground through the Front Enable Relay is present, open must be internal to Controller.
7. Determines **if open** is in solenoid or UB34.

CODE A013

LEFT FRONT RELEASE SOLENOID OPEN OR SHORTED TO GROUND

1. IGNITION IN "RUN."
   - IS CODE A010 ALSO SET?

NO

2. TURN LEFT FRONT RELEASE SOLENOID "OFF" AND ENABLE RELAYS "ON":
   - START AT TECH 1 MAIN MENUE
   - SELECT F4: ABS TESTS
   - SELECT FO: MANUAL CNTRL
   - SELECT F4: LF RELEASE
   - TURN CMD STATE: OFF
   - TURN ENAB RELAYS: ON

FEEDBACK STATE LOW

3. IGNITION IN "OFF".
   - DISCONNECT LEFT FRONT SOLENOID.
   - IGNITION IN "RUN".
   - CONNECT TEST LAMP BETWEEN TERMINALS "B" AND "C" OF LEFT FRONT SOLENOID HARNESS CONNECTOR.
   - TURN ENABLE RELAY5 "ON" AND LF RELEASE SOLENOID "OFF" (SEE ②).

TEST LAMP DOES NOT LIGHT

6. IGNITION IN "OFF".
   - RECONNECT LEFT FRONT SOLENOID.
   - DISCONNECT ABS CONTROLLER.
   - MEASURE RESISTANCE FROM TERMINAL "JI-C3" OF ABS CONTROLLER HARNESS CONNECTOR TO GROUND.

INFINITE OHMS

7. DISCONNECT LEFT FRONT SOLENOID.
   - MEASURE RESISTANCE BETWEEN TERMINALS "C" AND "B" OF LEFT FRONT SOLENOID.

APPROX 3 OHMS

REPAIR OPEN IN "UB34".

INFINITE OHMS

REPLACE LEFT FRONT SOLENOID.

10 OHMS OR LESS

CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER. IF CONTACT IS GOOD, REPLACE ABS CONTROLLER.

YES

5. DISCONNECT LEFT FRONT SOLENOID.
   - CONNECT TEST LAMP BETWEEN TERMINAL "B" OF LEFT FRONT SOLENOID HARNESS CONNECTOR AND GROUND.
   - TURN ENABLE RELAYS "ON" (SEE ②).

TEST LAMP DOES NOT LIGHT

REPAIR OPEN IN "PN51, PN53" BETWEEN LEFT FRONT SOLENOID AND FRONT ENABLE RELAY.

TEST LAMP LIGHTS

REPLACE LEFT FRONT SOLENOID.

FEEDBACK STATE HIGH

FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

TEST LAMP LIGHTS

4. IGNITION IN "OFF".
   - DISCONNECT ABS CONTROLLER AND TEST LAMP.
   - MEASURE RESISTANCE FROM TERMINAL "JI-C3" OF ABS CONTROLLER HARNESS CONNECTOR TO GROUND.

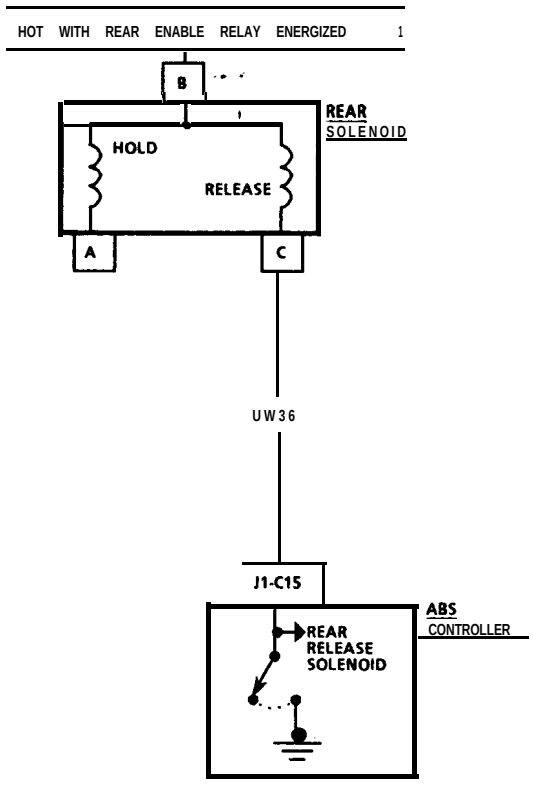
INFINITE OHMS

REPLACE ABS CONTROLLER.

10 OHMS OR LESS

REPAIR SHORT TO GROUND IN "UB34".

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODE5 AND VERIFY OPERATION.



CODE A014

REAR RELEASE SOLENOID OPEN OR SHORTED TO GROUND

When the Rear Enable Relay is energized, voltage is applied to the Rear Solenoid. If the ABS Controller determines that the Rear Release Solenoid should be activated, it will close the Rear Release Solenoid Control. Ground is now applied at terminal C of the Rear Solenoid, so the Rear Release Solenoid is on.
CODE A014 will set when all the following conditions exist:

- The Rear Enable Relay is energized.
- The Rear Release Solenoid Control is open.
- The ABS Controller senses no voltage at terminal "J1-C15".

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. If Code A011 is also set, the power feed to the Rear Solenoid is open.
2. Voltage at terminal "Jl-C15" will cause the TECH 1 to display a HIG feedback. A LOW feedback indicates that voltage is not present.
3. A short to ground must be present if the test lamp lights.
4. If short to ground does not exist with controller disconnected, short is internal to controller.
5. PN52 is OK if test lamp lights. Open must be internal to solenoid.
6. If test lamp lights, Rear Release Solenoid and UW36 are good. Open must be internal to controller.
7. Determines if open is in Solenoid or UW36.

CODE A014

REAR RELEASE SOLENOID OPEN OR SHORTED TO GROUND

1
- **IGNITION IN "RUN."**
- **IS CODE A011 ALSO SET?**

NO

2
- TURN REAR RELEASE SOLENOID "OFF" AND ENABLE RELAYS "ON":
  - START AT TECH 1 MAIN MENUE
  - SELECT F4: ABS TESTS
  - SELECT FO: MANUAL CNTRL
  - SELECT F6: REAR RELEASE
  - TURN CMD STATE: OFF
  - TURN ENAB RELAYS: ON

FEEDBACK STATE LOW

3
- IGNITION IN "OFF".
- DISCONNECT REAR SOLENOID.
- IGNITION IN "RUN".
- CONNECT TEST LAMP BETWEEN TERMINALS "B" AND **"C"** OF REAR SOLENOID HARNESS CONNECTOR.
- TURN ENABLE RELAYS "ON" AND REAR RELEASE SOLENOID "OFF" (SEE ②).

TEST LAMP DOES NOT LIGHT

- IGNITION IN "OFF".
- RECONNECT REAR SOLENOID.
- DISCONNECT ABS CONTROLLER.
- DISCONNECT REAR ENABLE RELAY.
- CONNECT FUSED JUMPER BETWEEN TERMINALS "87" AND "30'" OF REAR ENABLE RELAY HARNESS CONNECTOR.
- CONNECT TEST LAMP TO GROUND AT TERMINAL **"J1-C15"** OF ABS CONTROLLER HARNESS CONNECTOR.
- IGNITION IN "RUN".

TEST LAMP DOES NOT LIGHT

- IGNITION IN "OFF".
- DISCONNECT REAR SOLENOID.
- MEASURE RESISTANCE BETWEEN TERMINALS "C' AND "B" OF REAR SOLENOID.

APPROX 3 OHMS

REPAIR OPEN IN "UW36".

INFINITE OHMS

REPLACE REAR SOLENOID.

TEST LAMP LIGHTS

4
- IGNITION IN "OFF".
- DISCONNECT ABS CONTROLLER AND TEST LAMP.
- MEASURE RESISTANCE FROM **TERMINAL "J1-C15"** OF ABS CONTROLLER HARNESS CONNECTOR TO GROUND.

INFINITE OHMS

REPLACE ABS CONTROLLER.

10 OHMS OR LESS

REPAIR SHORT TO GROUND IN **"UW36".**

TEST LAMP LIGHTS

CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER. IF CONTACT IS GOOD, REPLACE ABS CONTROLLER.

FEEDBACK STATE HIGH

FAULT IS NOT PRESENT. **SEE** NOTE ON INTERMITTENTS IN INTRODUCTION.

5
- DISCONNECT REAR SOLENOID.
- CONNECT TEST LAMP BETWEEN TERMINAL **"B"** OF REAR SOLENOID HARNESS CONNECTOR AND GROUND.
- TURN ENABLE RELAYS **"ON"** (SEE ②).

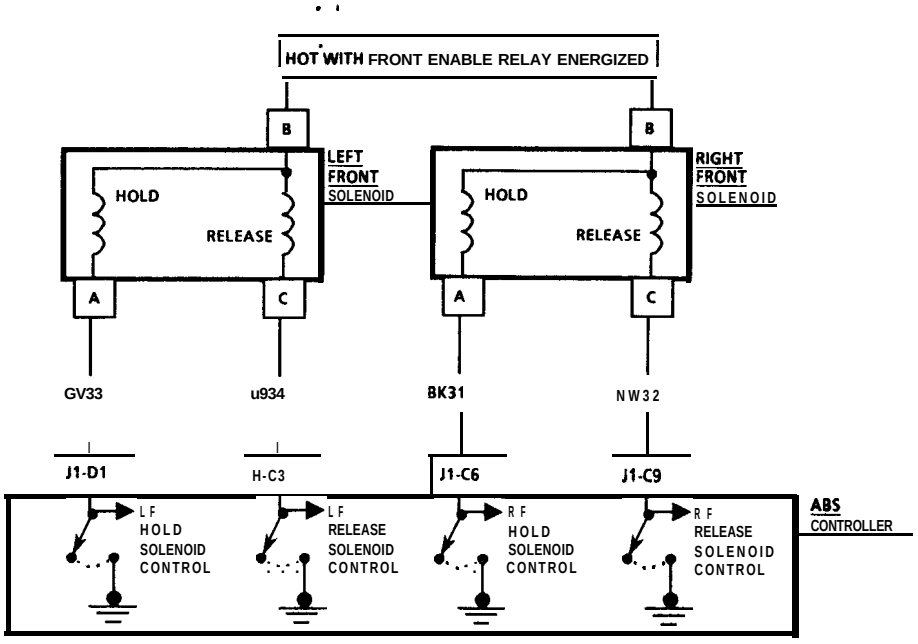
TEST LAMP DOES NOT LIGHT

REPAIR OPEN IN "PN52." BETWEEN REAR SOLENOID AND REAR ENABLE RELAY.

TEST LAMP LIGHTS

REPLACE REAR SOLENOID.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A01 5

ONE OR MORE FRONT SOLENOIDS SHORTED

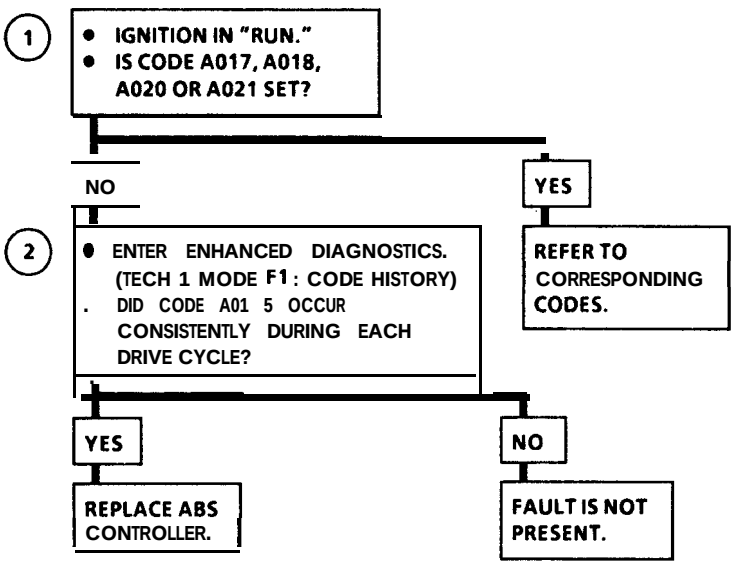
CODE A015 will set when the ABS Controller senses Battery voltage at Terminal **"J1-D1, J1-C3, J1-C6 or J1-C9"** when the corresponding Solenoid Control is closed.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

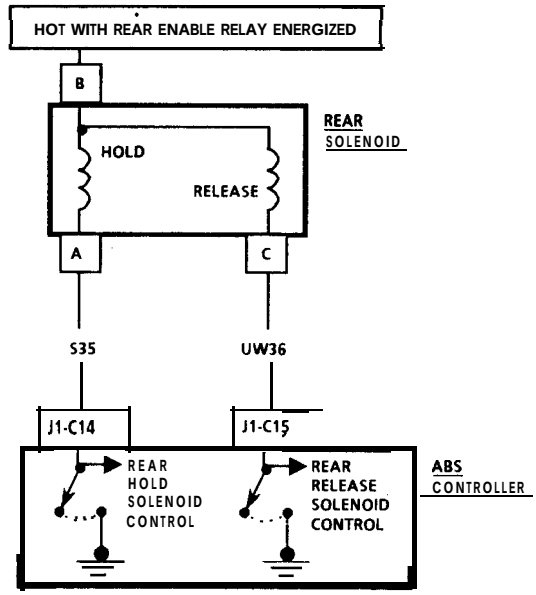
1. The reason for refering to these codes is that the fault that caused Code A015 to set will be linked to a specific circuit.
2. If the failure is consistent, ABS Controller has an internal fault.

CODE A01 5

ONE OR MORE FRONT SOLENOIDS SHORTED



AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE.
WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A01 6

ONE OR BOTH REAR SOLENOIDS SHORTED

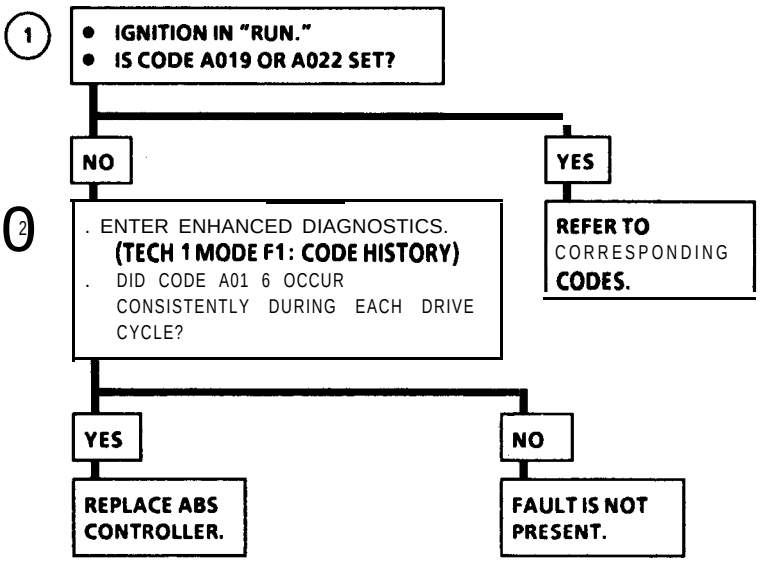
CODE A016 will set when the ABS Controller senses Battery voltage at Terminal "J1-C15 or "J1-C14" when the corresponding Solenoid Control is closed.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

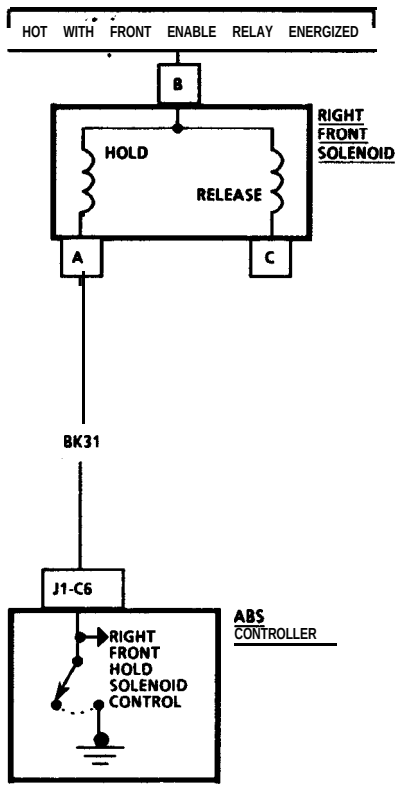
1. The reason for refering to these codes is that the fault that caused Code A016 to set will be linked to a specific circuit.
2. If the failure is consistent, ABS Controller has an internal fault.

CODE A016

ONE OR BOTH REAR SOLENOIDS SHORTED



AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A017

RIGHT FRONT HOLD SOLENOID SHORTED

When the Front Enable Relay is energized, voltage is applied to the Right Front Solenoid. If the **Right** Front Hold Solenoid Control is closed, ground is applied to BK31. This activates the Right Front Hold Solenoid.

CODE A017 will set during initialization when all the following conditions exist:

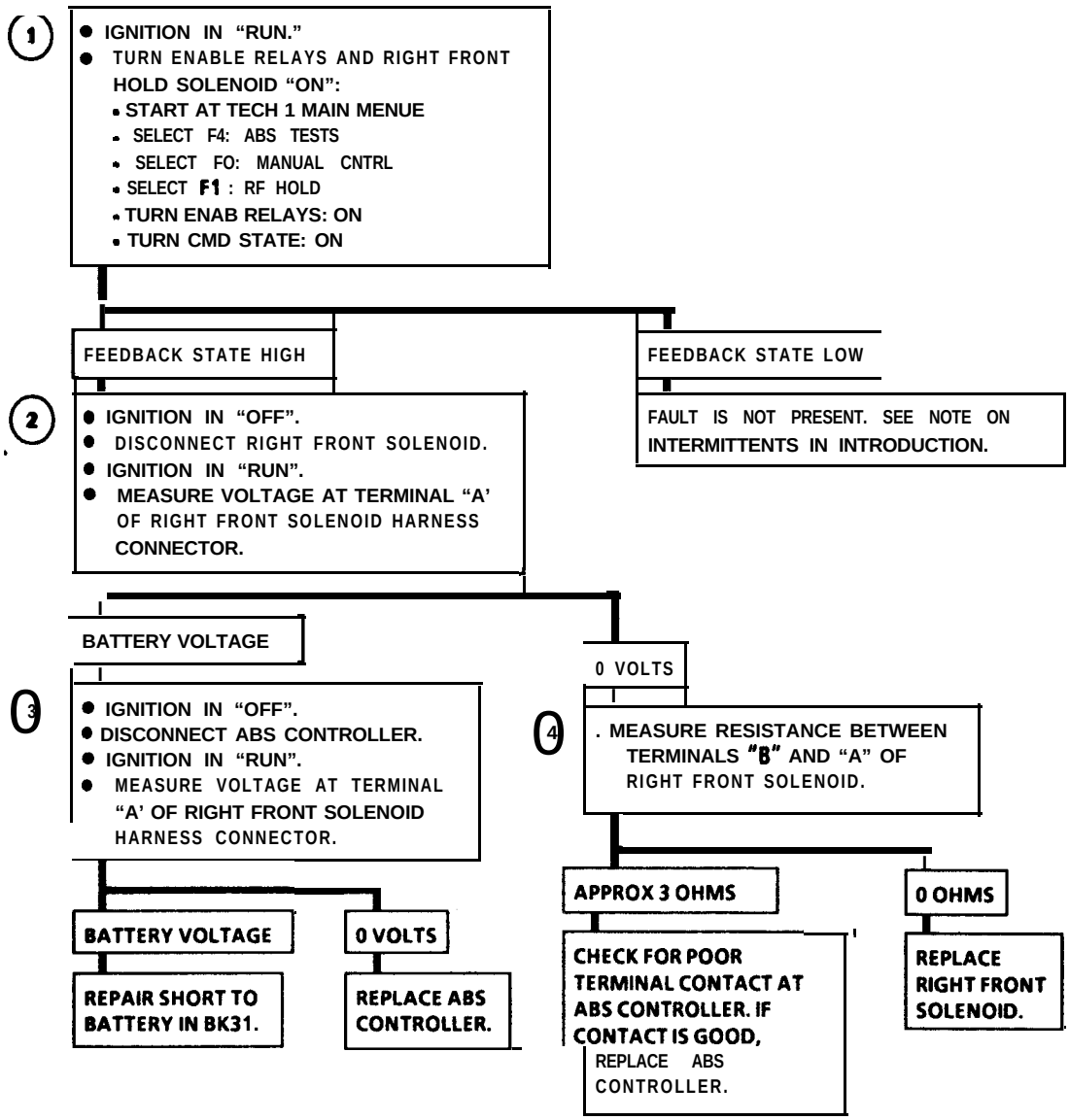
- The Front Enable Relay is energized.
- The Right Front Hold Solenoid Control is closed.
- The ABS Controller senses Battery voltage at Terminal "J1-C6".

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

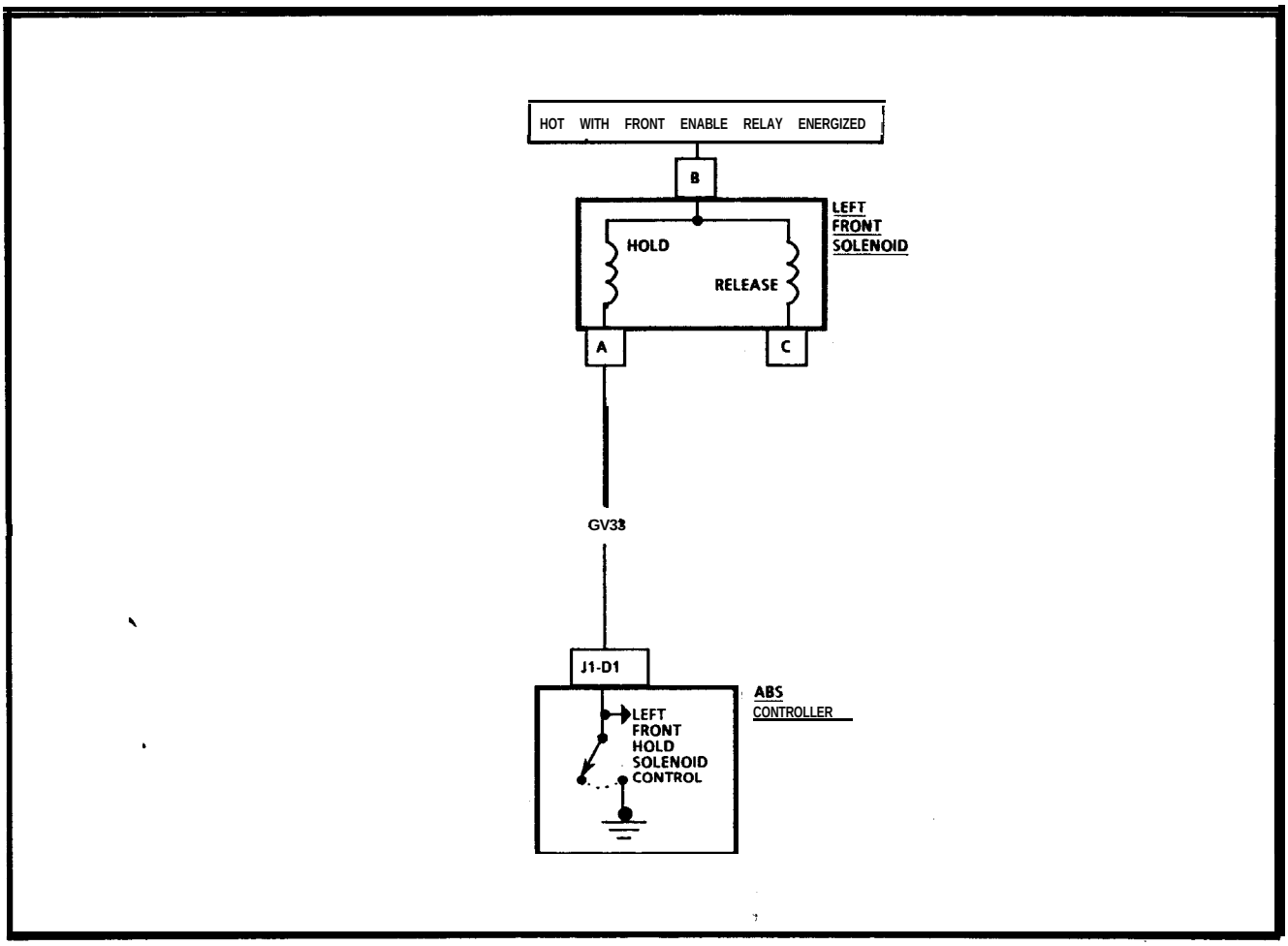
1. This determines if condition that set code A017 is still present.
2. Determines if short to Battery exists.
3. Determines if short to Battery is in BK31 or internal to the ABS Controller.
4. If Right Front Solenoid is not shorted, fault must be internal to the ABS Controller.

CODE A01 7

RIGHT FRONT HOLD SOLENOID SHORTED


1
IGNITION IN "RUN."
TURN ENABLE RELAYS AND RIGHT FRONT HOLD SOLENOID "ON":
START AT TECH 1 MAIN MENUE
SELECT F4: ABS TESTS
SELECT FO: MANUAL CNTRL
SELECT F1 : RF HOLD
TURN ENAB RELAYS: ON
TURN CMD STATE: ON
FEEDBACK STATE HIGH
FEEDBACK STATE LOW
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
2
IGNITION IN "OFF".
DISCONNECT RIGHT FRONT SOLENOID.
IGNITION IN "RUN".
MEASURE VOLTAGE AT TERMINAL "A' OF RIGHT FRONT SOLENOID HARNESS CONNECTOR.
BATTERY VOLTAGE
0 VOLTS
3
IGNITION IN "OFF".
DISCONNECT ABS CONTROLLER.
IGNITION IN "RUN".
MEASURE VOLTAGE AT TERMINAL "A' OF RIGHT FRONT SOLENOID HARNESS CONNECTOR.
4
. MEASURE RESISTANCE BETWEEN TERMINALS "B" AND "A" OF RIGHT FRONT SOLENOID.
BATTERY VOLTAGE
0 VOLTS
APPROX 3 OHMS
0 OHMS
REPAIR SHORT TO BATTERY IN BK31.
REPLACE ABS CONTROLLER.
CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER. IF CONTACT IS GOOD,
REPLACE ABS CONTROLLER.
REPLACE RIGHT FRONT SOLENOID.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A018

LEFT FRONT HOLD SOLENOID SHORTED

When the Front Enable Relay is energized, voltage is applied to the Left Front Solenoid. If the Left Front Hold Solenoid Control is closed, ground is applied to GY33. This activates the Left Front Hold Solenoid.

CODE A018 will set during initialization when all the following conditions exist:

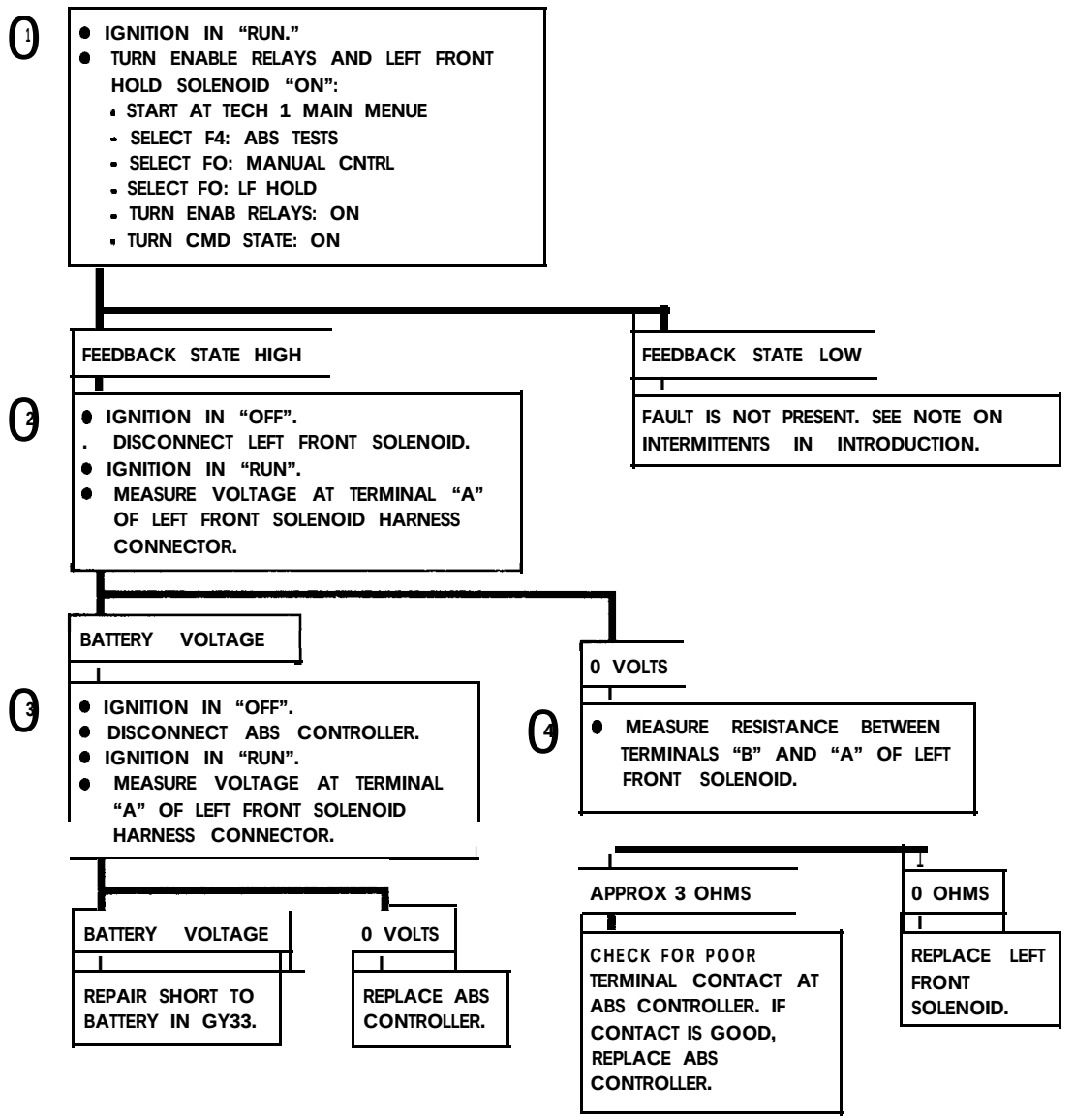
- The Front Enable Relay is energized.
- The Left Front Hold Solenoid Control is closed.
- The ABS Controller senses Battery voltage at Terminal "J1-D1".

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

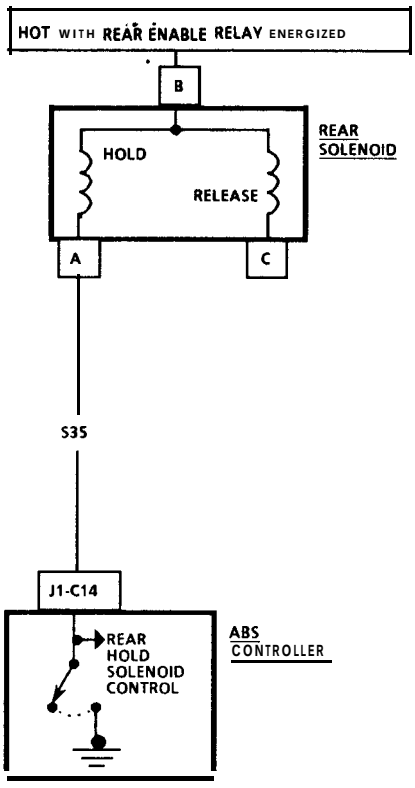
1. This determines ifcondition that set code A018 is still present.
2. Checks if short to Battery is in GY33 or internal to ABS Controller.
3. Determines if short to Battery is in GY33 or internal to the ABS Controller.
4. If Left Front Solenoid is not shorted, fault must be internal to the ABS Controller.

CODE A018

LEFT FRONT HOLD SOLENOID SHORTED


1
IGNITION IN "RUN."
TURN ENABLE RELAYS AND LEFT FRONT HOLD SOLENOID "ON":
START AT TECH 1 MAIN MENUE
SELECT F4: ABS TESTS
SELECT FO: MANUAL CNTRL
SELECT FO: LF HOLD
TURN ENAB RELAYS: ON
TURN CMD STATE: ON
FEEDBACK STATE HIGH
FEEDBACK STATE LOW
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
2
IGNITION IN "OFF".
DISCONNECT LEFT FRONT SOLENOID.
IGNITION IN "RUN".
MEASURE VOLTAGE AT TERMINAL "A" OF LEFT FRONT SOLENOID HARNESS CONNECTOR.
BATTERY VOLTAGE
0 VOLTS
3
IGNITION IN "OFF".
DISCONNECT ABS CONTROLLER.
IGNITION IN "RUN".
MEASURE VOLTAGE AT TERMINAL "A" OF LEFT FRONT SOLENOID HARNESS CONNECTOR.
4
MEASURE RESISTANCE BETWEEN TERMINALS "B" AND "A" OF LEFT FRONT SOLENOID.
BATTERY VOLTAGE
0 VOLTS
APPROX 3 OHMS
0 OHMS
REPAIR SHORT TO BATTERY IN GY33.
REPLACE ABS CONTROLLER.
CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER. IF CONTACT IS GOOD, REPLACE ABS CONTROLLER.
REPLACE LEFT FRONT SOLENOID.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A019

REAR HOLD SOLENOID SHORTED

When the Rear Enable Relay is energized, voltage is applied to the Rear Solenoid. If the Rear Hold Solenoid Control is closed, ground is applied to S35. This activates the Rear Hold Solenoid.
CODE A019 will set during initialization when all the following conditions exist:

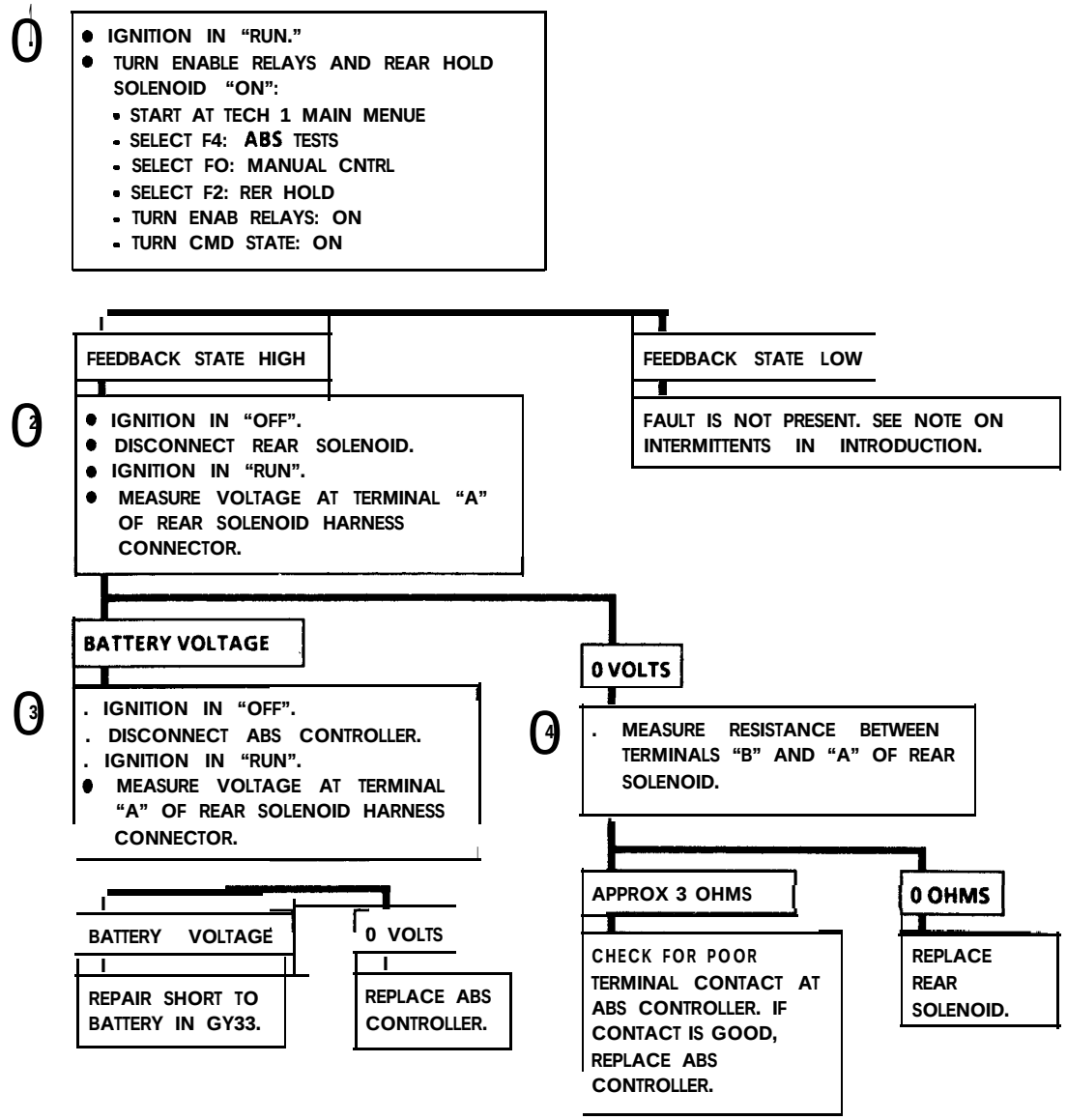
- The Rear Enable Relay is energized.
- The Rear Hold Solenoid Control is closed.
- The ABS Controller senses Battery voltage at Terminal "Jl-C14".

Test Description; The following provides an explanation of the procedures being followed in the facing trouble tree.

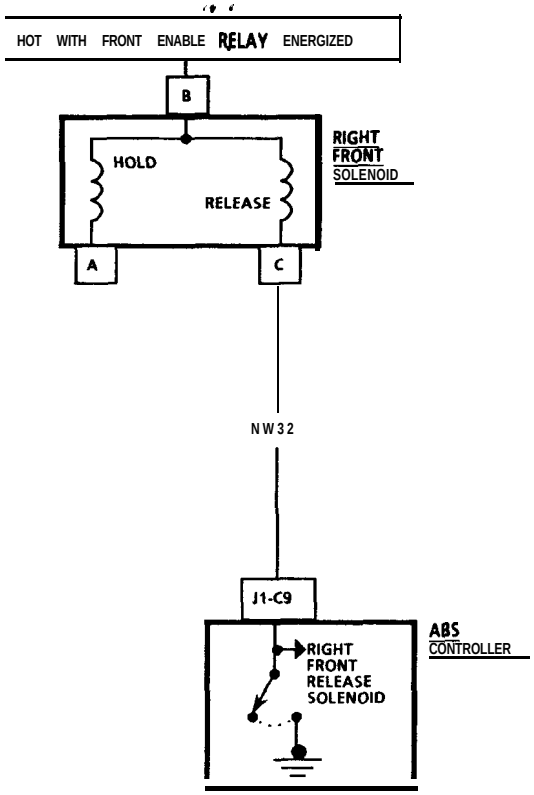
1. This determines if condition that set code A019 is still present.
2. Checks if short to Battery is in S35 or internal of ABS Controller.
3. Determines if short to Battery is in S35 or internal to the ABS Controller.
4. If Rear Solenoid is not shorted, fault must be internal to the ABS Controller.

CODE A019

REAR HOLD SOLENOID SHORTED


1
• IGNITION IN "RUN."
• TURN ENABLE RELAYS AND REAR HOLD SOLENOID "ON":
- START AT TECH 1 MAIN MENUE
- SELECT F4: ABS TESTS
- SELECT FO: MANUAL CNTRL
- SELECT F2: RER HOLD
- TURN ENAB RELAYS: ON
- TURN CMD STATE: ON
FEEDBACK STATE HIGH
FEEDBACK STATE LOW
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
2
• IGNITION IN "OFF".
• DISCONNECT REAR SOLENOID.
• IGNITION IN "RUN".
• MEASURE VOLTAGE AT TERMINAL "A" OF REAR SOLENOID HARNESS CONNECTOR.
BATTERY VOLTAGE
0 VOLTS
3
. IGNITION IN "OFF".
. DISCONNECT ABS CONTROLLER.
. IGNITION IN "RUN".
• MEASURE VOLTAGE AT TERMINAL "A" OF REAR SOLENOID HARNESS CONNECTOR.
4
. MEASURE RESISTANCE BETWEEN TERMINALS "B" AND "A" OF REAR SOLENOID.
BATTERY VOLTAGE
0 VOLTS
REPAIR SHORT TO BATTERY IN GY33.
REPLACE ABS CONTROLLER.
APPROX 3 OHMS
0 OHMS
CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER. IF CONTACT IS GOOD, REPLACE ABS CONTROLLER.
REPLACE REAR SOLENOID.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A020

RIGHT FRONT RELEASE SOLENOID SHORTED

When the Front Enable Relay is energized, voltage is applied to the Right Front Solenoid. If the Right Front Release Solenoid Control is closed, ground is applied to NW32. This activates the Right Front Release Solenoid.

CODE A020 will set during initialization when all the following conditions exist:

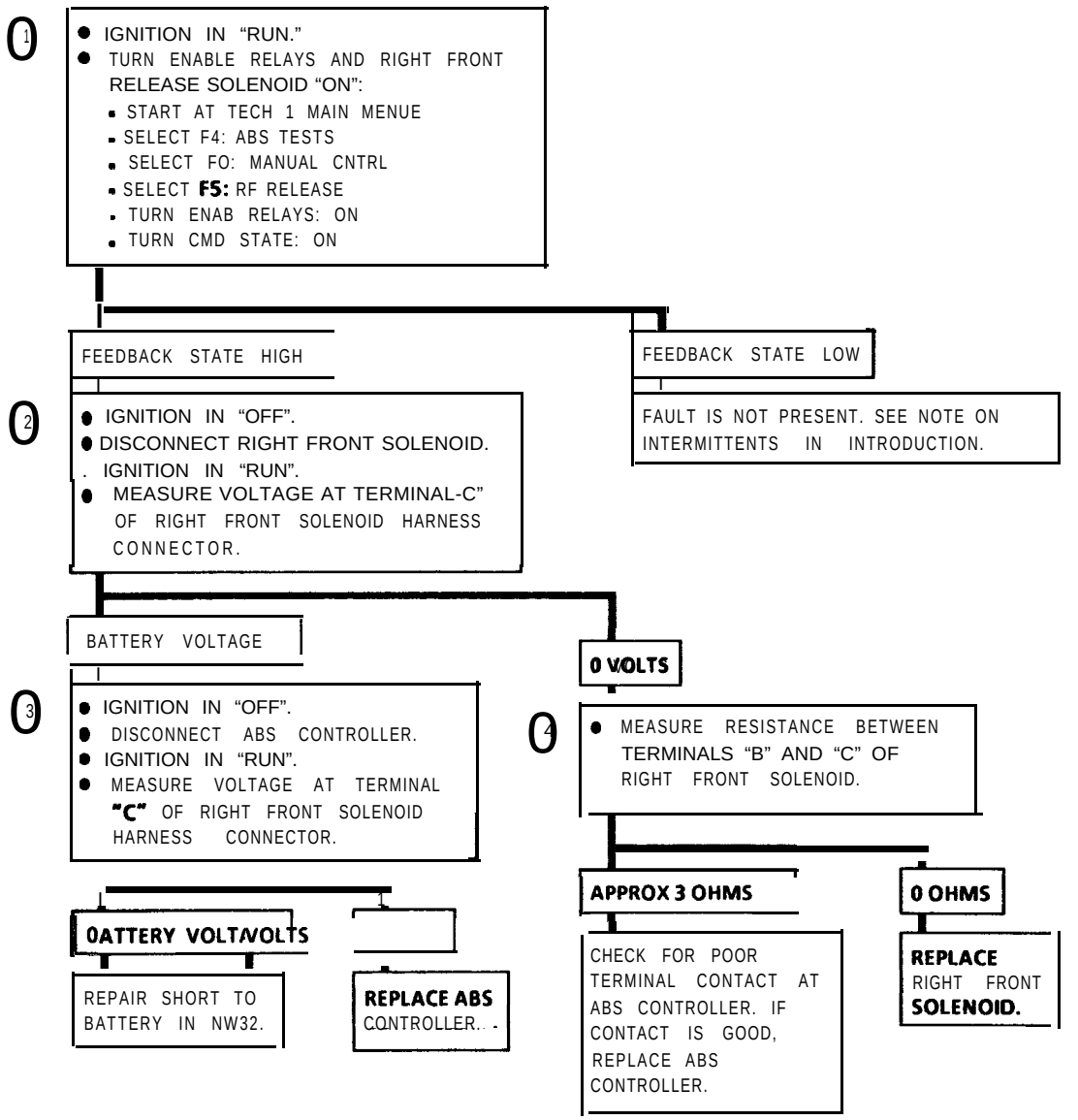
- The Front Enable Relay is energized.
- The Right Front Release Solenoid Control is closed.
- The ABS Controller senses Battery voltage at Terminal "J1-C9".

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

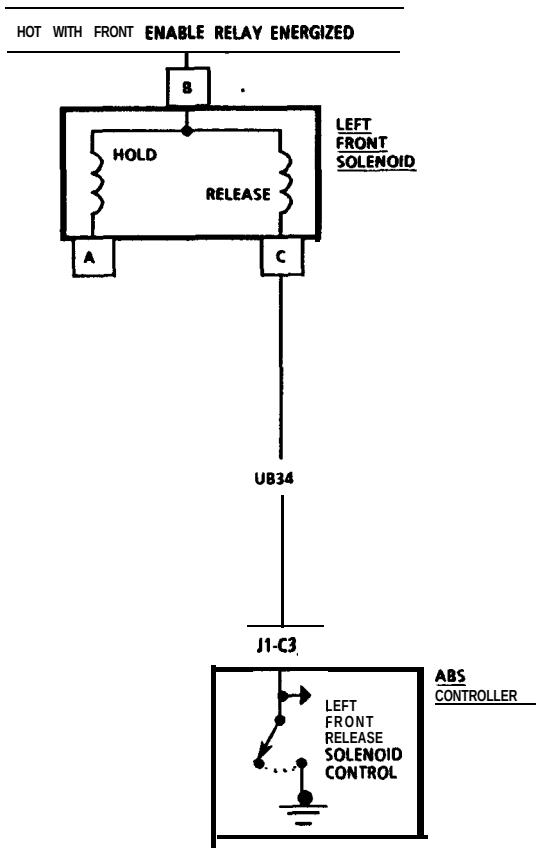
1. This determines ifcondition that set Code A020 is still present.
2. Checks if short to Battery exists.
3. Determines if short to Battery is in NW32 or internal to ABS Controller.
4. If Right Front Solenoid is not shorted, fault must be internal to ABS Controller.

CODE A020

RIGHT FRONT RELEASE SOLENOID SHORTED


1
IGNITION IN "RUN."
TURN ENABLE RELAYS AND RIGHT FRONT RELEASE SOLENOID "ON":
START AT TECH 1 MAIN MENUE
SELECT F4: ABS TESTS
SELECT FO: MANUAL CNTRL
SELECT F5: RF RELEASE
TURN ENAB RELAYS: ON
TURN CMD STATE: ON
FEEDBACK STATE HIGH
FEEDBACK STATE LOW
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
2
IGNITION IN "OFF".
DISCONNECT RIGHT FRONT SOLENOID.
IGNITION IN "RUN".
MEASURE VOLTAGE AT TERMINAL-C" OF RIGHT FRONT SOLENOID HARNESS CONNECTOR.
BATTERY VOLTAGE
0 VOLTS
3
IGNITION IN "OFF".
DISCONNECT ABS CONTROLLER.
IGNITION IN "RUN".
MEASURE VOLTAGE AT TERMINAL "C" OF RIGHT FRONT SOLENOID HARNESS CONNECTOR.
4
MEASURE RESISTANCE BETWEEN TERMINALS "B" AND "C" OF RIGHT FRONT SOLENOID.
0ATTERY VOLTAVOLTS
REPAIR SHORT TO BATTERY IN NW32.
REPLACE ABS CONTROLLER.
APPROX 3 OHMS
0 OHMS
CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER. IF CONTACT IS GOOD, REPLACE ABS CONTROLLER.
REPLACE RIGHT FRONT SOLENOID.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A021

LEFT FRONT RELEASE SOLENOID SHORTED

When the Front Enable Relay is energized, voltage is applied to the Left Front Solenoid. If the Left Front Release Solenoid Control is closed, ground is applied to UB34. This activates the **Left** Front Release Solenoid.

CODE A021 will set during initialization when all the following conditions exist:

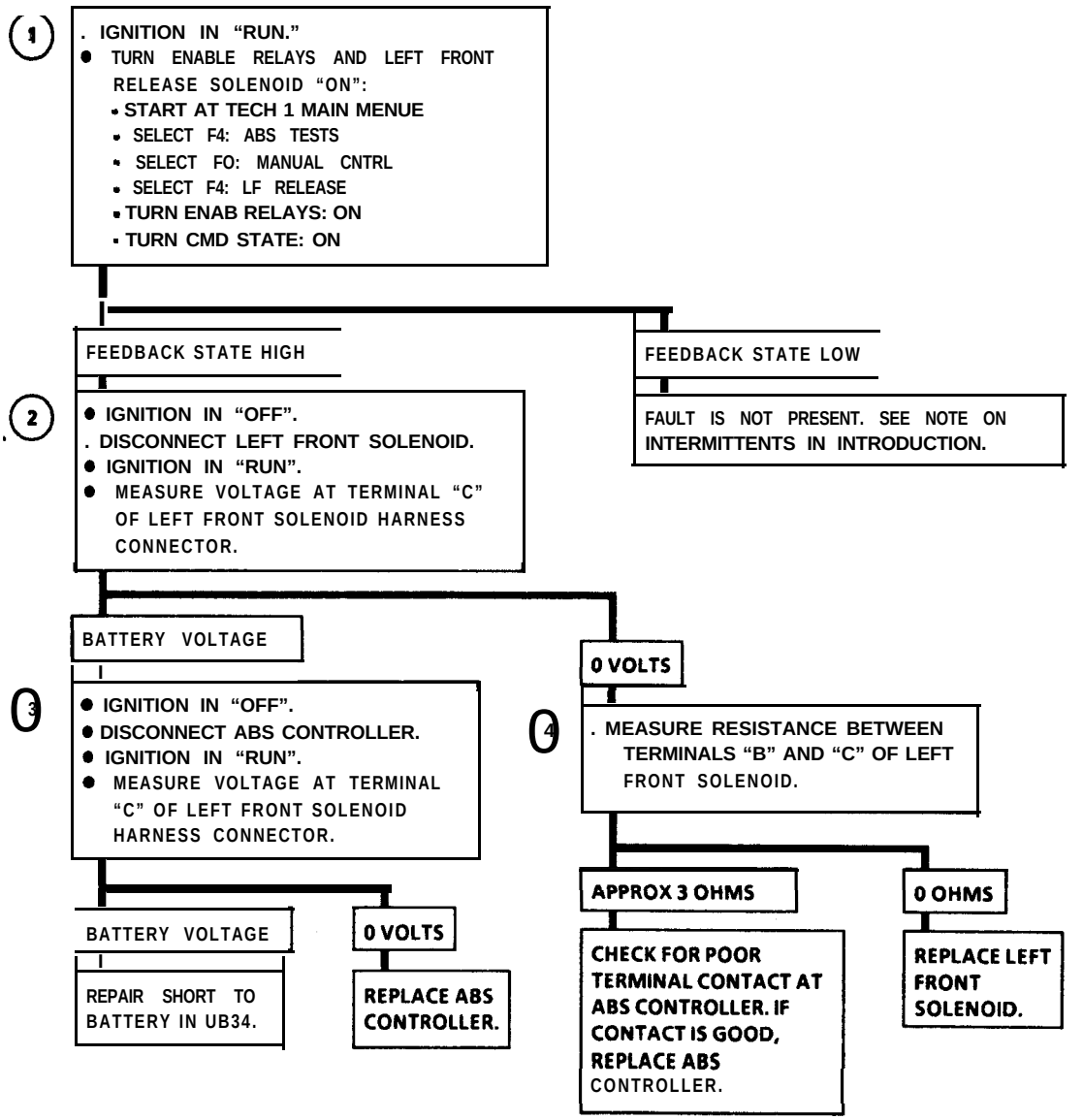
- The Front Enable Relay is energized.
- The Left Front Release Solenoid Control is closed.
- The ABS Controller senses Battery voltage at Terminal **"J1-C3".**

Test Description: The foliowing provides an explanation of the procedures being followed in the facing trouble tree.

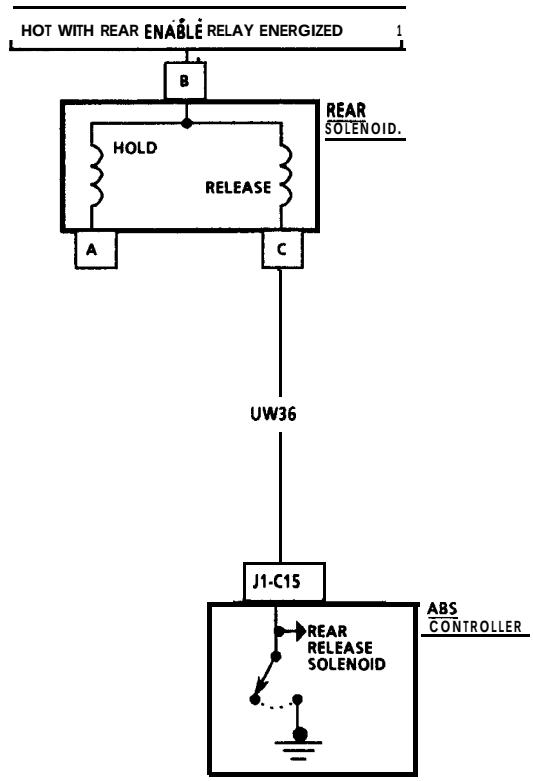
1. This determines if condition that set Code A021 is still present.
2. Checks **if short** to Battery exists.
3. Determines if short to Battery is in UB34 or internal to ABS Controller.
4. If Left Front Solenoid is not shorted, fault must be internal to ABS Controller.

CODE A021

LEFT FRONT RELEASE SOLENOID SHORTED


1
. IGNITION IN "RUN."
● TURN ENABLE RELAYS AND LEFT FRONT RELEASE SOLENOID "ON":
• START AT TECH 1 MAIN MENUE
• SELECT F4: ABS TESTS
• SELECT FO: MANUAL CNTRL
• SELECT F4: LF RELEASE
• TURN ENAB RELAYS: ON
• TURN CMD STATE: ON
FEEDBACK STATE HIGH
FEEDBACK STATE LOW
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
2
● IGNITION IN "OFF".
. DISCONNECT LEFT FRONT SOLENOID.
● IGNITION IN "RUN".
● MEASURE VOLTAGE AT TERMINAL "C" OF LEFT FRONT SOLENOID HARNESS CONNECTOR.
BATTERY VOLTAGE
0 VOLTS
3
● IGNITION IN "OFF".
● DISCONNECT ABS CONTROLLER.
● IGNITION IN "RUN".
● MEASURE VOLTAGE AT TERMINAL "C" OF LEFT FRONT SOLENOID HARNESS CONNECTOR.
4
. MEASURE RESISTANCE BETWEEN TERMINALS "B" AND "C" OF LEFT FRONT SOLENOID.
BATTERY VOLTAGE
0 VOLTS
APPROX 3 OHMS
0 OHMS
REPAIR SHORT TO BATTERY IN UB34.
REPLACE ABS CONTROLLER.
CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER. IF CONTACT IS GOOD, REPLACE ABS CONTROLLER.
REPLACE LEFT FRONT SOLENOID.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A022

REAR RELEASE SOLENOID SHORTED

When the Rear Enable Relay is energized, voltage is applied to the Rear Solenoid. If the Rear Release Solenoid Control is closed, ground is applied to UW36. This activates the Rear Release Solenoid.

CODE A022 will set during initialization when all the following conditions exist:

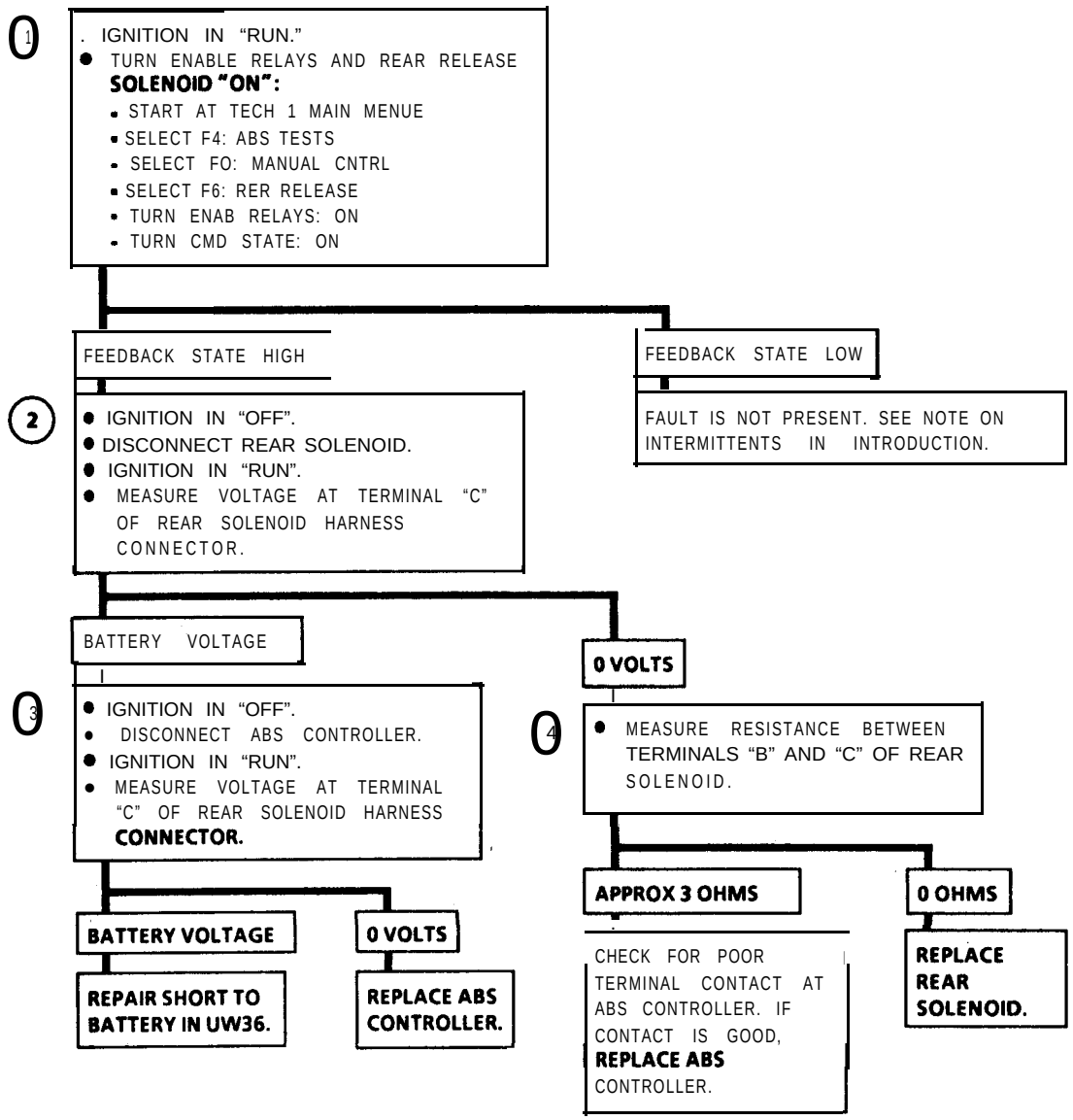
- The Rear Enable Relay is energized.
- The Rear Release Solenoid Control is closed.
- The ABS Controller senses Battery voltage at Terminal "J1-C15".

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

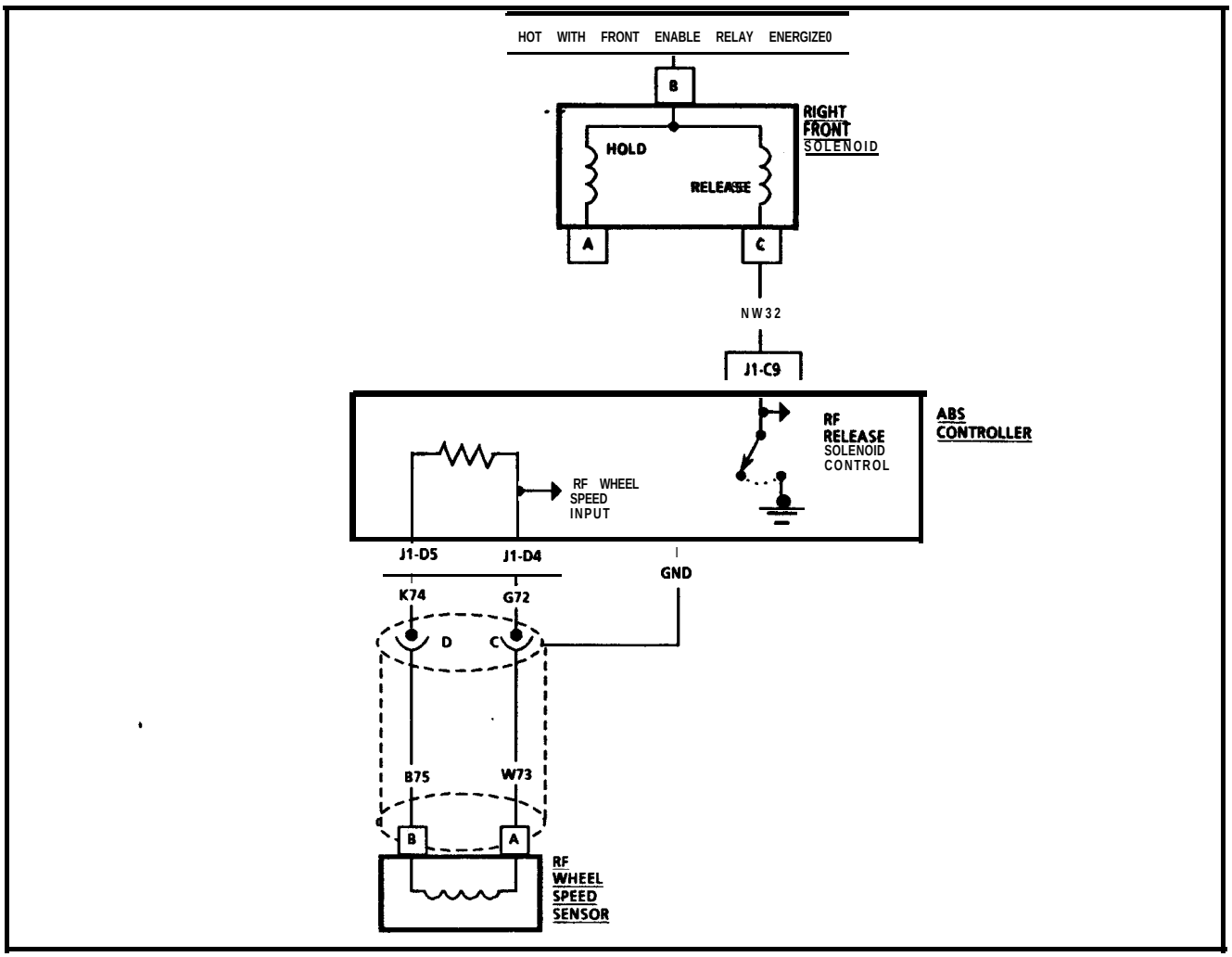
1. This determines if condition that set Code A022 is still present.
2. Checks if short to Battery exists.
3. Determines if short to Battery is in UW36 or internal to ABS Controller.
4. If Rear Solenoid is not shorted, fault must be internal to ABS Controller.

CODE A022

REAR RELEASE SOLENOID SHORTED


1
IGNITION IN "RUN."
TURN ENABLE RELAYS AND REAR RELEASE SOLENOID "ON":
START AT TECH 1 MAIN MENUE
SELECT F4: ABS TESTS
SELECT FO: MANUAL CNTRL
SELECT F6: RER RELEASE
TURN ENAB RELAYS: ON
TURN CMD STATE: ON
FEEDBACK STATE HIGH
FEEDBACK STATE LOW
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
2
IGNITION IN "OFF".
DISCONNECT REAR SOLENOID.
IGNITION IN "RUN".
MEASURE VOLTAGE AT TERMINAL "C" OF REAR SOLENOID HARNESS CONNECTOR.
BATTERY VOLTAGE
0 VOLTS
3
IGNITION IN "OFF".
DISCONNECT ABS CONTROLLER.
IGNITION IN "RUN".
MEASURE VOLTAGE AT TERMINAL "C" OF REAR SOLENOID HARNESS CONNECTOR.
4
MEASURE RESISTANCE BETWEEN TERMINALS "B" AND "C" OF REAR SOLENOID.
BATTERY VOLTAGE
0 VOLTS
APPROX 3 OHMS
0 OHMS
REPAIR SHORT TO BATTERY IN UW36.
REPLACE ABS CONTROLLER.
CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER. IF CONTACT IS GOOD, REPLACE ABS CONTROLLER.
REPLACE REAR SOLENOID.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, Is GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A023

RIGHT FRONT RELEASE SOLENOID ENERGIZED TOO LONG

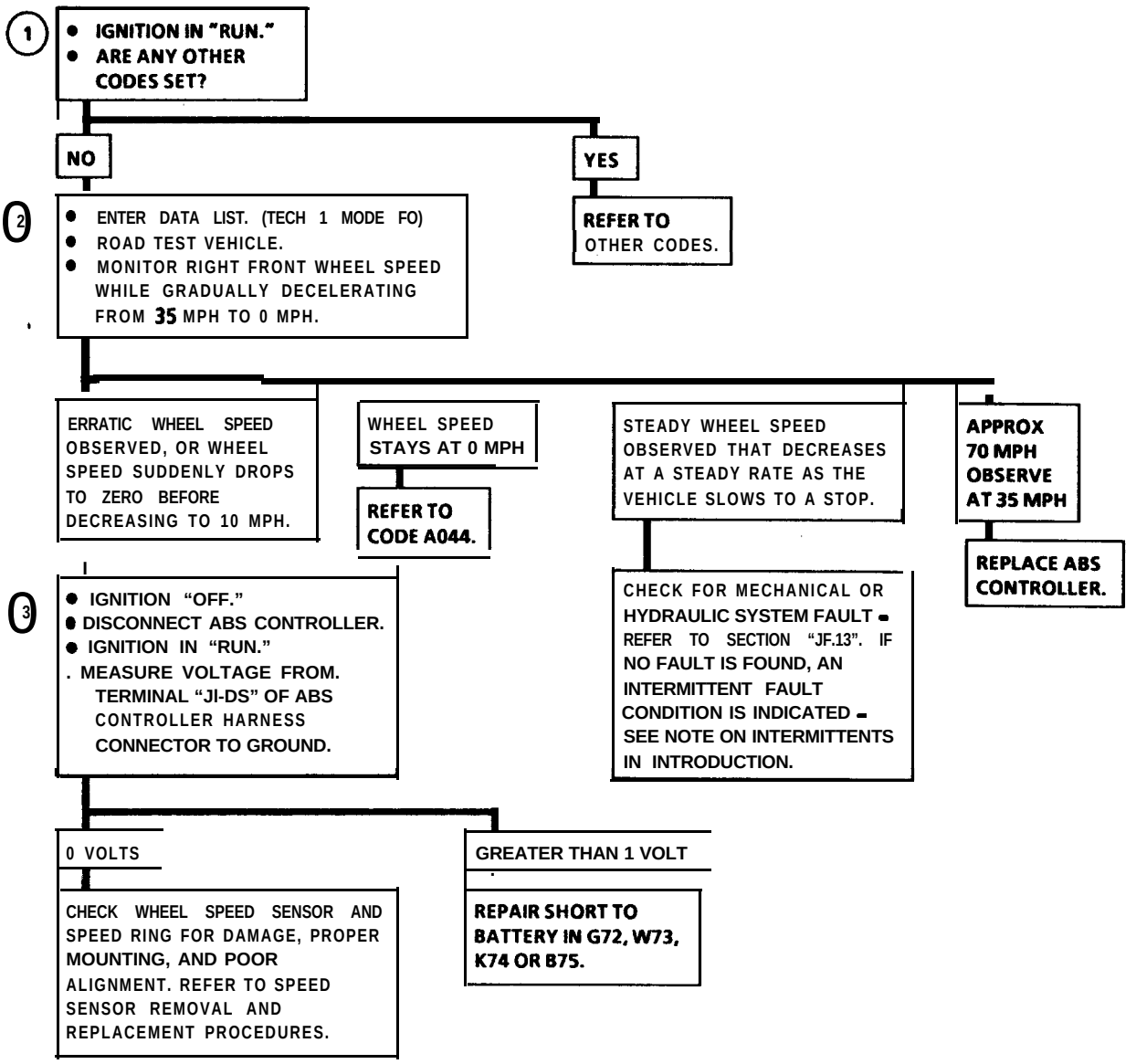
By monitoring the Right Front Wheel Speed Sensor, the ABS Controller can determine if the Right Front Wheel is locking up. If this condition occurs, the controller will activate the Right Front Release Solenoid by closing the Right Front Release Solenoid Control. The Solenoid Control will be closed until the Controller determines that the Right Front Wheel has increased to an acceptable speed.
CODE A023 will set when the ABS Controller senses that the Right Front Release Solenoid has been energized longer than proper operation requires.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

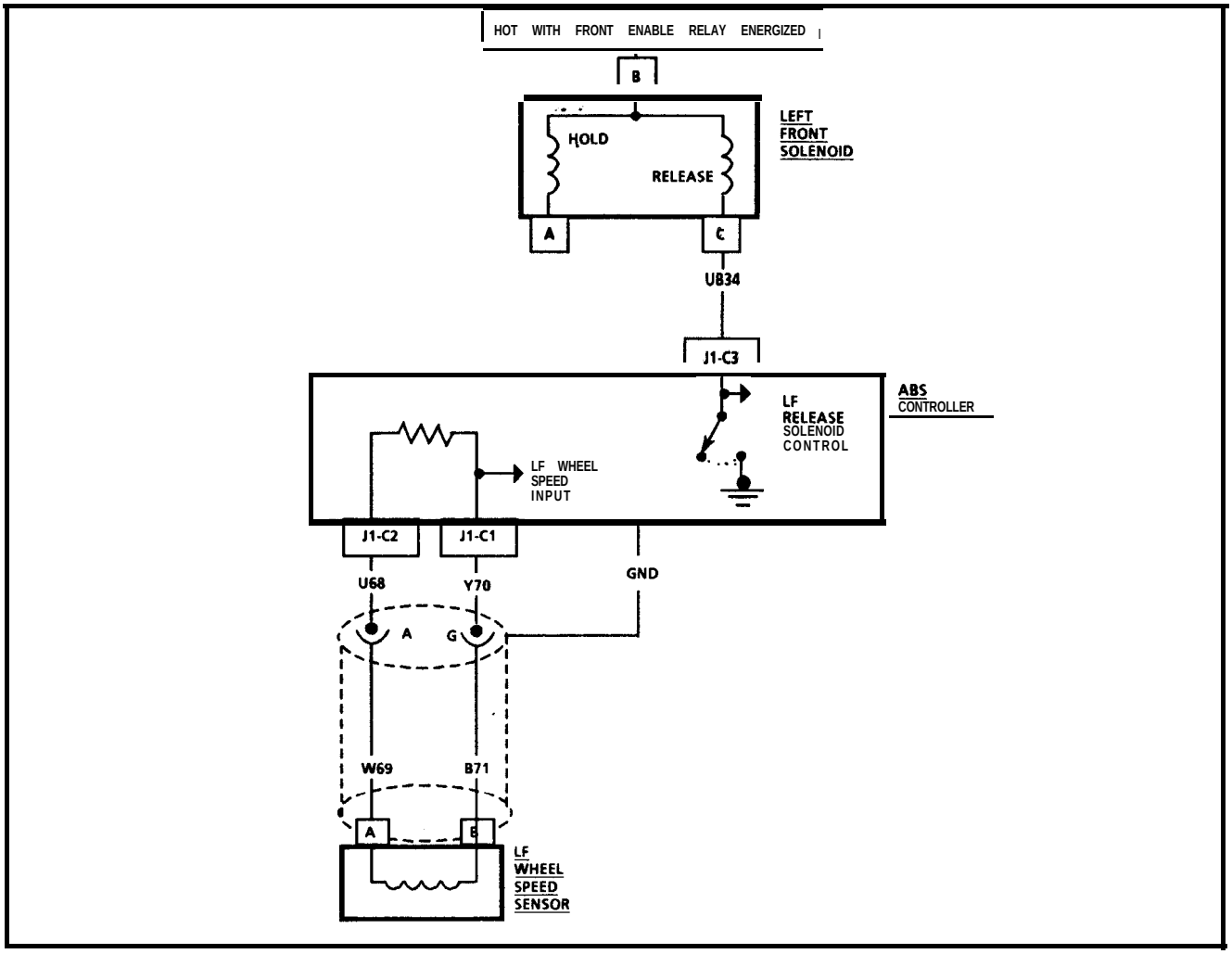
1. If any other codes are set they should be addressed first. The reason for this is that the fault that caused the solenoid to be energized too long will be better identified.
2. By examining the Right Front Wheel Speed input, it can be determined if the fault is due to erratic wheel speed inputs which occur only at low speeds.
   If the wheel speed input is found to be steady at a low speed a mechanical or hydraulic problem is indicated - refer to Section "JF.13". A wheel speed that stays at 0 MPH indicates an open. Refer to Code A044.
3. This checks for a possible short to voltage on G72, W73, K74 or B75.

CODE A023

RIGHT FRONT RELEASE SOLENOID ENERGIZED TOO LONG


1
• IGNITION IN "RUN."
• ARE ANY OTHER CODES SET?
NO
YES
REFER TO OTHER CODES.
2
• ENTER DATA LIST. (TECH 1 MODE FO)
• ROAD TEST VEHICLE.
• MONITOR RIGHT FRONT WHEEL SPEED WHILE GRADUALLY DECELERATING FROM 35 MPH TO 0 MPH.
ERRATIC WHEEL SPEED OBSERVED, OR WHEEL SPEED SUDDENLY DROPS TO ZERO BEFORE DECREASING TO 10 MPH.
WHEEL SPEED STAYS AT 0 MPH
REFER TO CODE A044.
STEADY WHEEL SPEED OBSERVED THAT DECREASES AT A STEADY RATE AS THE VEHICLE SLOWS TO A STOP.
CHECK FOR MECHANICAL OR HYDRAULIC SYSTEM FAULT - REFER TO SECTION "JF.13". IF NO FAULT IS FOUND, AN INTERMITTENT FAULT CONDITION IS INDICATED - SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
APPROX 70 MPH OBSERVE AT 35 MPH
REPLACE ABS CONTROLLER.
3
• IGNITION "OFF."
• DISCONNECT ABS CONTROLLER.
• IGNITION IN "RUN."
• MEASURE VOLTAGE FROM. TERMINAL "JI-DS" OF ABS CONTROLLER HARNESS CONNECTOR TO GROUND.
0 VOLTS
CHECK WHEEL SPEED SENSOR AND SPEED RING FOR DAMAGE, PROPER MOUNTING, AND POOR ALIGNMENT. REFER TO SPEED SENSOR REMOVAL AND REPLACEMENT PROCEDURES.
GREATER THAN 1 VOLT
REPAIR SHORT TO BATTERY IN G72, W73, K74 OR B75.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A024

LEFT FRONT RELEASE SOLENOID ENERGIZED TOO LONG

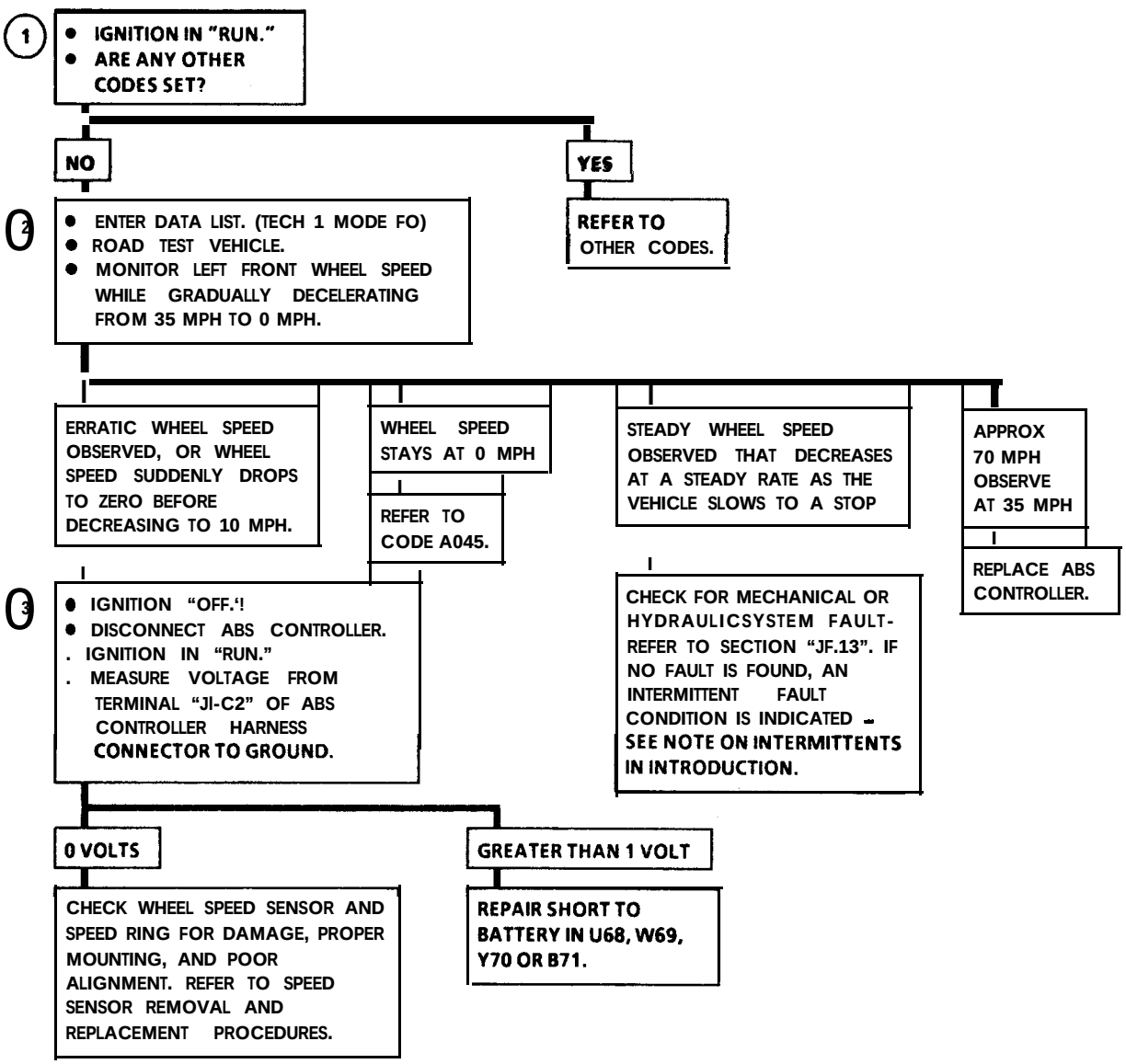
By monitoring the Left Front Wheel Speed Sensor, the ABS Controller can determine if the Left Front Wheel is locking up during an ABS stop. If this condition occurs, the Controller will activate the Left Front Release Solenoid by closing the Left Front Release Solenoid Control. The Solenoid Control will be closed until the Controller determines that the Left Front Wheel has increased to an acceptable speed.
CODE A024 will set when the ABS Controller senses that the Left Front Release Solenoid has been energized longer than proper operation requires.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

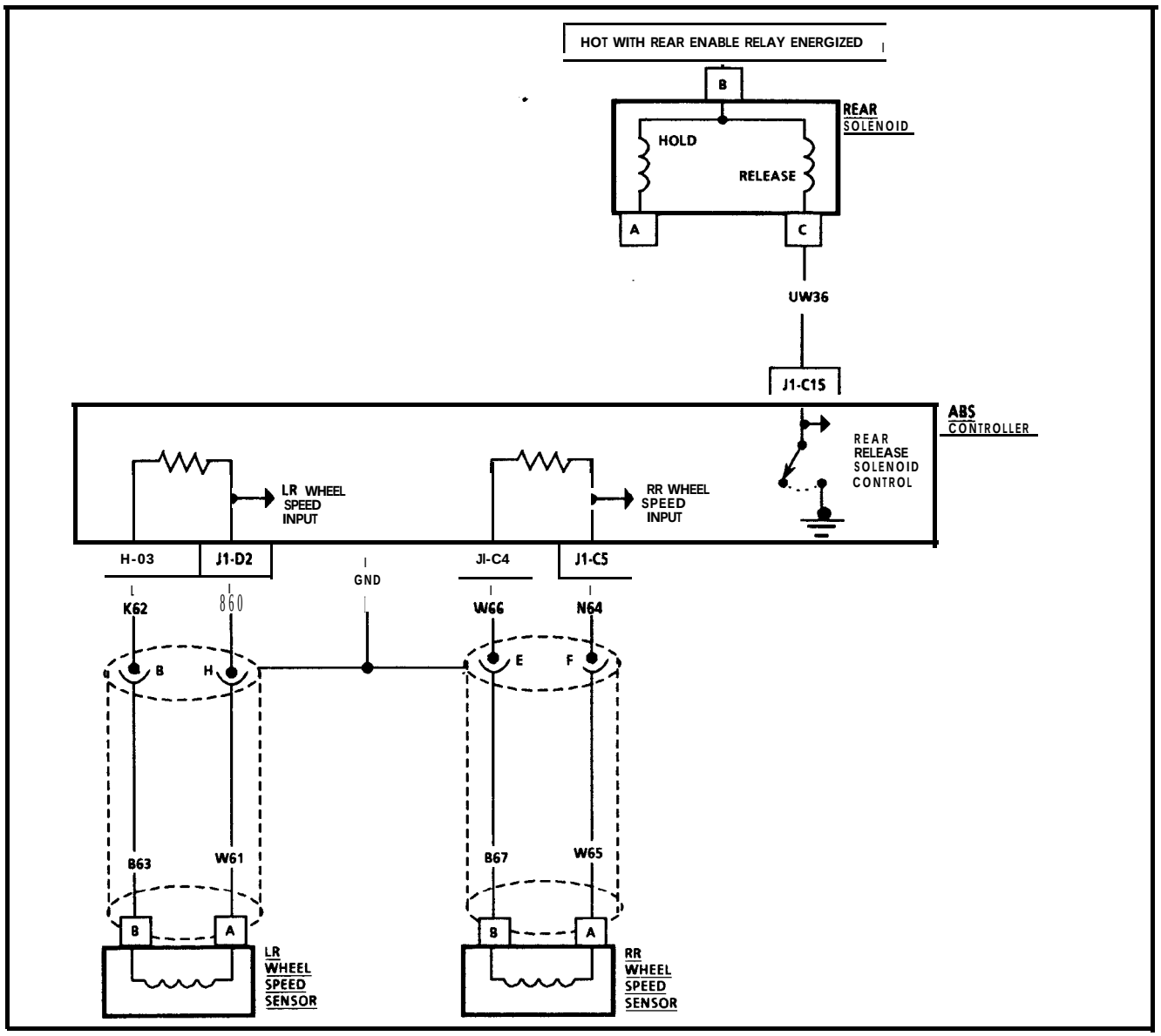
1. If any other codes are set they should be addressed first: The reason for this is that the fault that caused the solenoid to be energized too long will be better identified.
2. By examining the Left Front Wheel Speed input, it can be determined if the fault is due to erratic wheel speed inputs which occur only at low speeds. if the wheel speed input is found to be steady at a low speed a mechanical or hydraulic problem is indicated - refer to Section "JF. 13". A wheel speed that stays at 0 MPH indicates an open - refer to Code A045.
3. This checks for a possible short to voltage on U68, W69, Y70 or B71.

CODE A024

LEFT FRONT RELEASE SOLENOID ENERGIZED TOO LONG


1
• IGNITION IN "RUN."
• ARE ANY OTHER CODES SET?
NO
YES
REFER TO OTHER CODES.
2
• ENTER DATA LIST. (TECH 1 MODE FO)
• ROAD TEST VEHICLE.
• MONITOR LEFT FRONT WHEEL SPEED WHILE GRADUALLY DECELERATING FROM 35 MPH TO 0 MPH.
ERRATIC WHEEL SPEED OBSERVED, OR WHEEL SPEED SUDDENLY DROPS TO ZERO BEFORE DECREASING TO 10 MPH.
WHEEL SPEED STAYS AT 0 MPH
REFER TO CODE A045.
STEADY WHEEL SPEED OBSERVED THAT DECREASES AT A STEADY RATE AS THE VEHICLE SLOWS TO A STOP
APPROX 70 MPH OBSERVE AT 35 MPH
REPLACE ABS CONTROLLER.
3
• IGNITION "OFF.'!
• DISCONNECT ABS CONTROLLER.
. IGNITION IN "RUN."
. MEASURE VOLTAGE FROM TERMINAL "JI-C2" OF ABS CONTROLLER HARNESS CONNECTOR TO GROUND.
CHECK FOR MECHANICAL OR HYDRAULICSYSTEM FAULT- REFER TO SECTION "JF.13". IF NO FAULT IS FOUND, AN INTERMITTENT FAULT CONDITION IS INDICATED - SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
0 VOLTS
GREATER THAN 1 VOLT
CHECK WHEEL SPEED SENSOR AND SPEED RING FOR DAMAGE, PROPER MOUNTING, AND POOR ALIGNMENT. REFER TO SPEED SENSOR REMOVAL AND REPLACEMENT PROCEDURES.
REPAIR SHORT TO BATTERY IN U68, W69, Y70 OR B71.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A025

REAR RELEASE SOLENOID ENERGIZED TOO LONG

By monitoring the Rear Wheel Speed Sensors, the ABS Controller can determine if a rear wheel is locking up during an ABS stop. If the condition occurs, the Controller will activate the Rear Release Solenoid by closing the Rear Release Solenoid Control. The Solenoid Control will be closed until the ABS Controller determines that both rear wheels have increased to acceptable speeds.

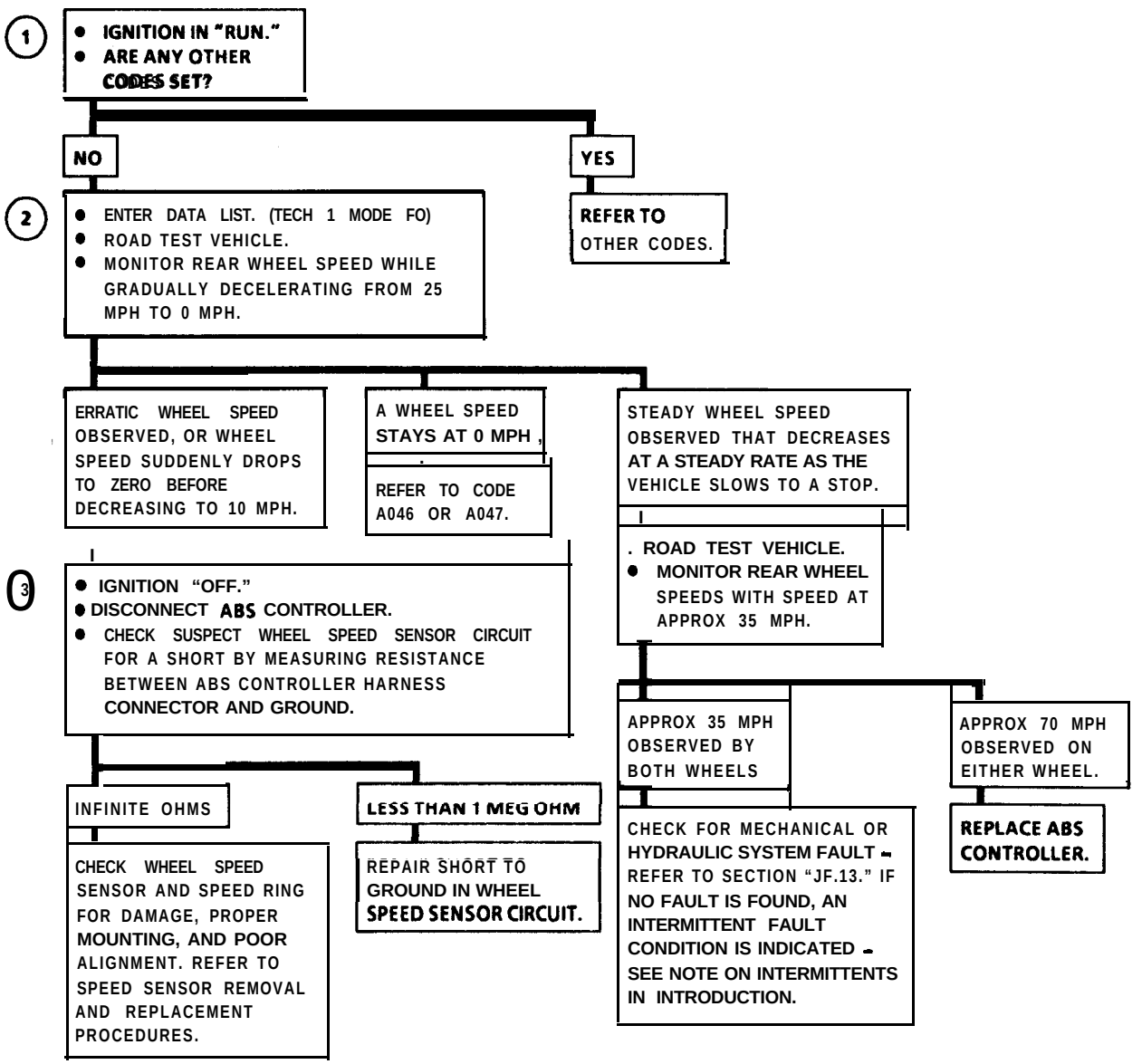
CODE A025 will set when the ABS Controller senses that the Rear Release Solenoid has been energized longer than proper operation requires.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

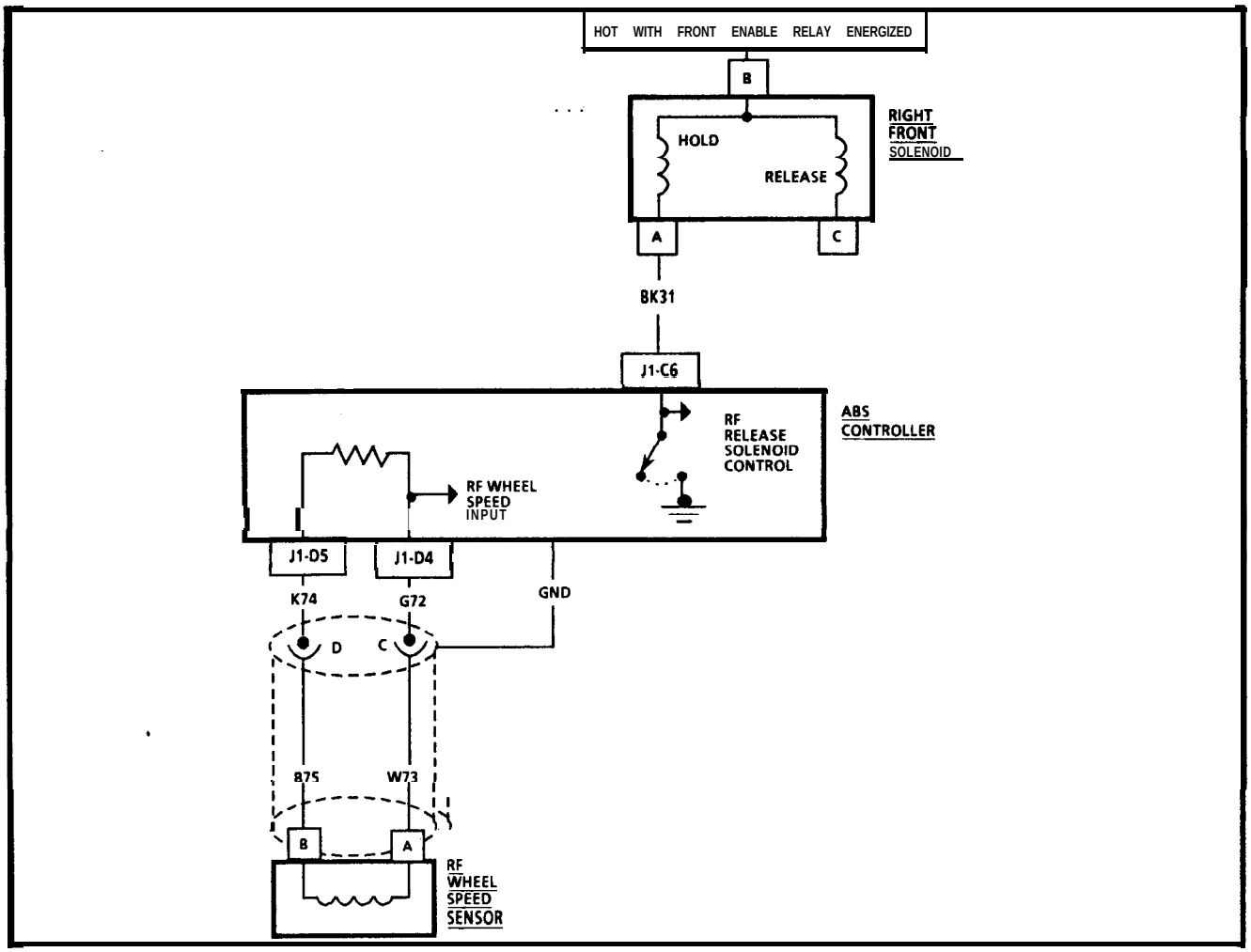
1. If any other codes are set they should be addressed first. The reason for this is that the fault that caused the solenoid to be energized too long will be better identified.
2. By examining the rear wheel speed inputs, it can be determined if the fault is due to erratic wheel speed inputs which occur only at low speeds. If the wheel speed input is found to be steady at low speed, a mechanical or hydraulic problem is indicated-refer to Section "JF.13". A wheel speed that stays at 0 MPH indicates an open - refer to Code A046 or A047.
3. This checks for a possible short to ground on the suspect Wheel Speed Sensor Circuit.

CODE A025

REAR RELEASE SOLENOID ENERGIZED TOO LONG


1
• IGNITION IN "RUN."
• ARE ANY OTHER CODES SET?
NO
YES
REFER TO OTHER CODES.
2
• ENTER DATA LIST. (TECH 1 MODE FO)
• ROAD TEST VEHICLE.
• MONITOR REAR WHEEL SPEED WHILE GRADUALLY DECELERATING FROM 25 MPH TO 0 MPH.
ERRATIC WHEEL SPEED OBSERVED, OR WHEEL SPEED SUDDENLY DROPS TO ZERO BEFORE DECREASING TO 10 MPH.
A WHEEL SPEED STAYS AT 0 MPH
REFER TO CODE A046 OR A047.
STEADY WHEEL SPEED OBSERVED THAT DECREASES AT A STEADY RATE AS THE VEHICLE SLOWS TO A STOP.
3
• IGNITION "OFF."
• DISCONNECT ABS CONTROLLER.
• CHECK SUSPECT WHEEL SPEED SENSOR CIRCUIT FOR A SHORT BY MEASURING RESISTANCE BETWEEN ABS CONTROLLER HARNESS CONNECTOR AND GROUND.
. ROAD TEST VEHICLE.
• MONITOR REAR WHEEL SPEEDS WITH SPEED AT APPROX 35 MPH.
INFINITE OHMS
LESS THAN 1 MEG OHM
APPROX 35 MPH OBSERVED BY BOTH WHEELS
APPROX 70 MPH OBSERVED ON EITHER WHEEL.
CHECK WHEEL SPEED SENSOR AND SPEED RING FOR DAMAGE, PROPER MOUNTING, AND POOR ALIGNMENT. REFER TO SPEED SENSOR REMOVAL AND REPLACEMENT PROCEDURES.
REPAIR SHORT TO GROUND IN WHEEL SPEED SENSOR CIRCUIT.
CHECK FOR MECHANICAL OR HYDRAULIC SYSTEM FAULT - REFER TO SECTION "JF.13." IF NO FAULT IS FOUND, AN INTERMITTENT FAULT CONDITION IS INDICATED - SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
REPLACE ABS CONTROLLER.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A026

RIGHT FRONT HOLD SOLENOID ENERGIZED TOO LONG

By monitoring the Right Front Wheel Speed Sensor, the ABS Controller can determine if the Right Front Wheel is not decelerating properly during an ABS stop. If this condition occurs, the Controller will activate the Right Front Hold Solenoid by closing the Right Front Hold Solenoid Control. The Solenoid Control will be closed until the ABS Controller determines that the Right Front Wheel has decreased to an acceptable speed.

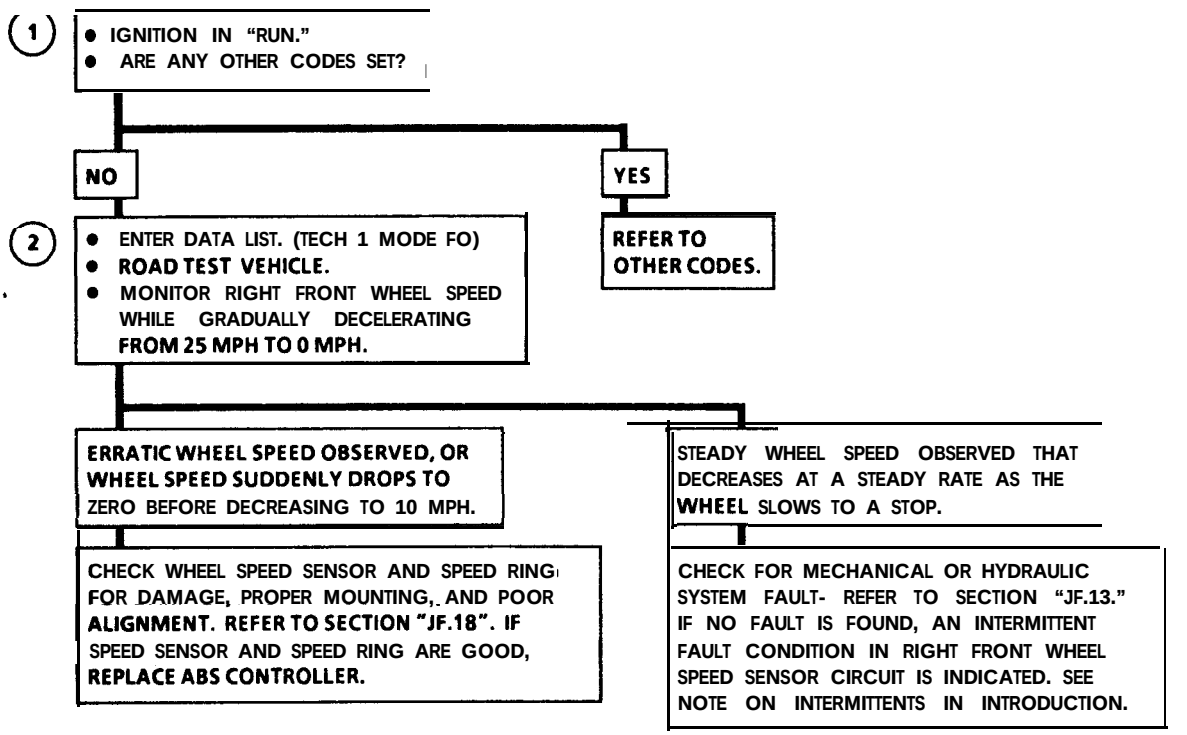
CODE A026 will set when the ABS Controller senses that the Right Front Hold Solenoid has been energized longer than proper operation requires.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

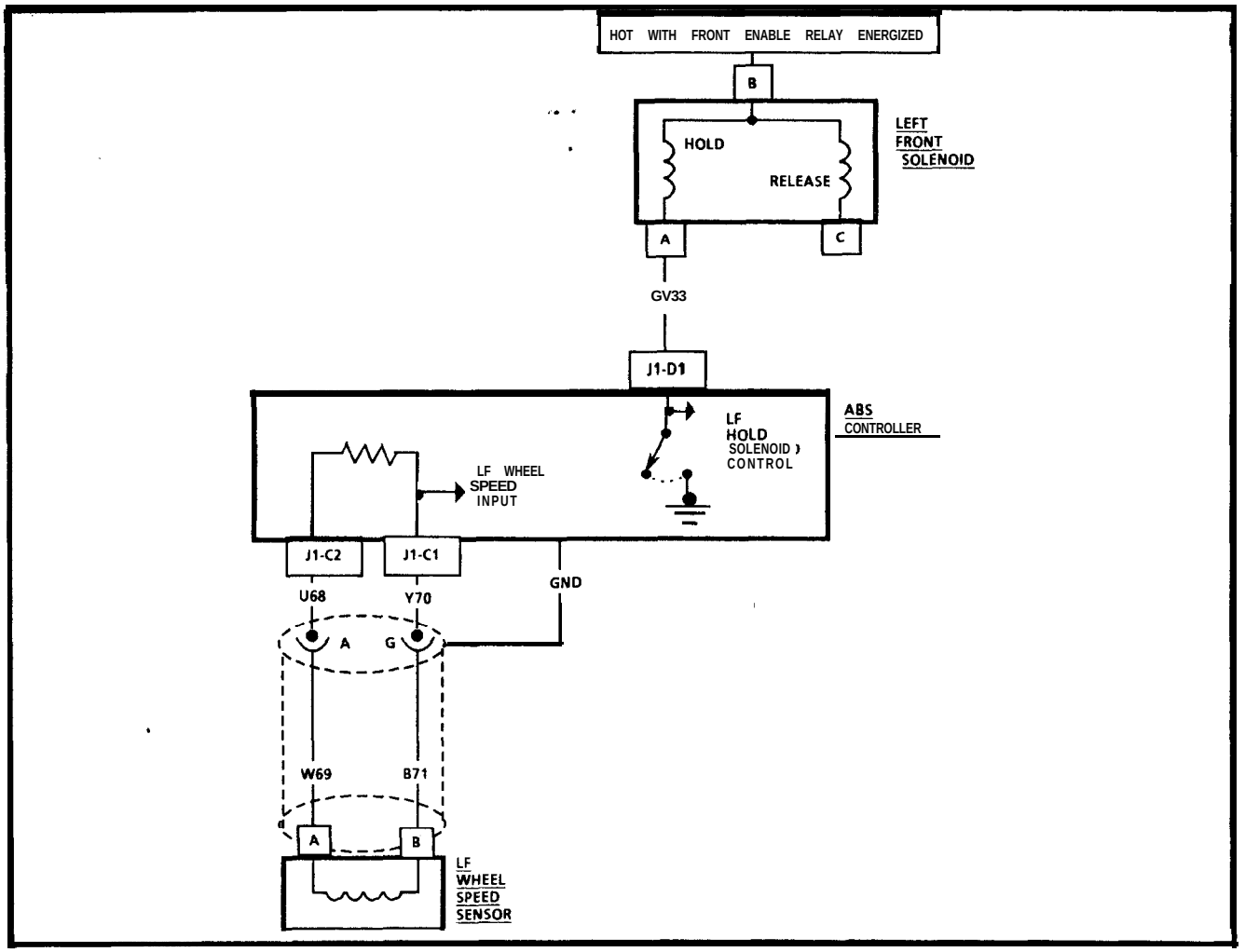
1. If any other codes are set, they should be addressed first. The reason for this is that the fault that caused the solenoid to be energized too long will be better identified.
2. By examining the Right Front Wheel Speed input, it can be determined if the fault is due to erratic wheel speed inputs which occur only at low speeds. If the wheel speed input is found to be steady at a low speed, a mechanical or hydraulic problem is indicated.

CODE A026

RIGHT FRONT HOLD SOLENOID ENERGIZED TOO LONG


1
• IGNITION IN "RUN."
• ARE ANY OTHER CODES SET?
NO
YES
REFER TO OTHER CODES.
2
• ENTER DATA LIST. (TECH 1 MODE FO)
• ROAD TEST VEHICLE.
• MONITOR RIGHT FRONT WHEEL SPEED WHILE GRADUALLY DECELERATING FROM 25 MPH TO 0 MPH.
ERRATIC WHEEL SPEED OBSERVED, OR WHEEL SPEED SUDDENLY DROPS TO ZERO BEFORE DECREASING TO 10 MPH.
STEADY WHEEL SPEED OBSERVED THAT DECREASES AT A STEADY RATE AS THE WHEEL SLOWS TO A STOP.
CHECK WHEEL SPEED SENSOR AND SPEED RING FOR DAMAGE, PROPER MOUNTING, AND POOR ALIGNMENT. REFER TO SECTION "JF.18". IF SPEED SENSOR AND SPEED RING ARE GOOD, REPLACE ABS CONTROLLER.
CHECK FOR MECHANICAL OR HYDRAULIC SYSTEM FAULT- REFER TO SECTION "JF.13." IF NO FAULT IS FOUND, AN INTERMITTENT FAULT CONDITION IN RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT IS INDICATED. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A027

LEFT FRONT HOLD SOLENOID ENERGIZED TOO LONG

By monitoring the Left Front Wheel Speed Sensor, the ABS Controller can determine if the Left Front Wheel is not decelerating properly during an ABS stop. If this condition occurs, the ABS Controller will activate the Left Front Hold Solenoid by closing the Left Front Hold Solenoid Control. The Solenoid Control will be closed until the ABS Controller determines that the Left Front Wheel has decreased to an acceptable speed.

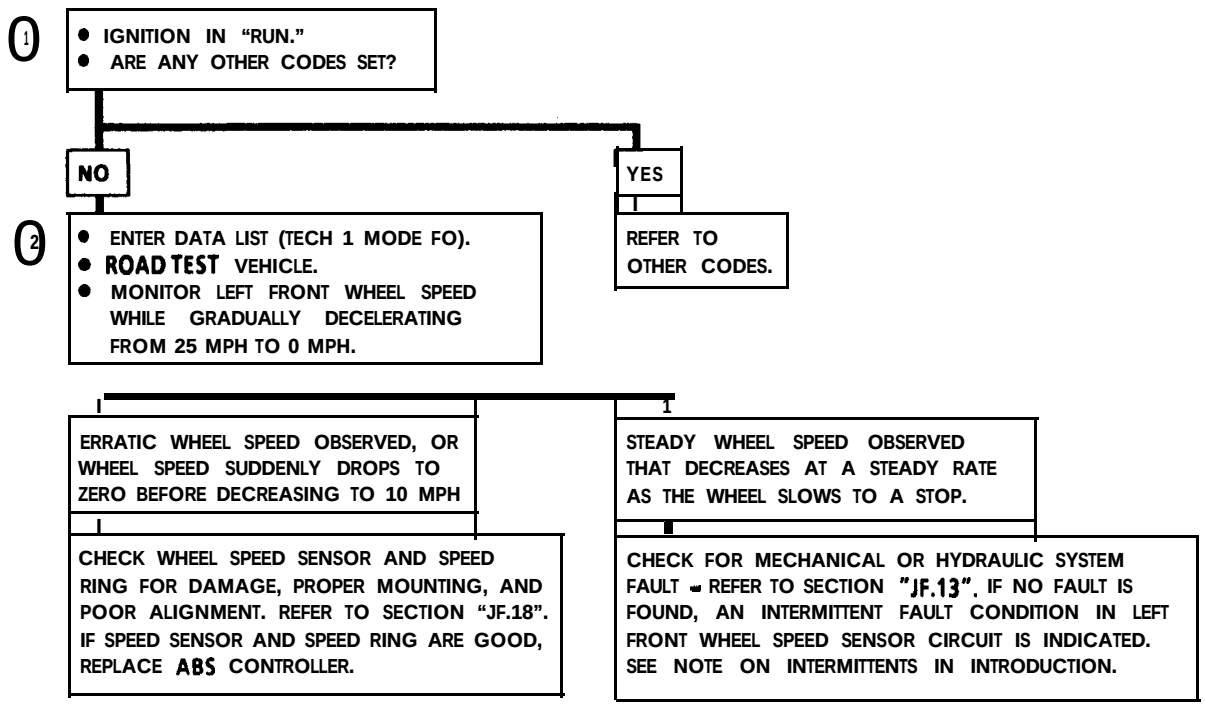
CODE A027 will set when the ABS Controller senses that the Left Front Hold Solenoid has been energized longer than proper operation requires.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

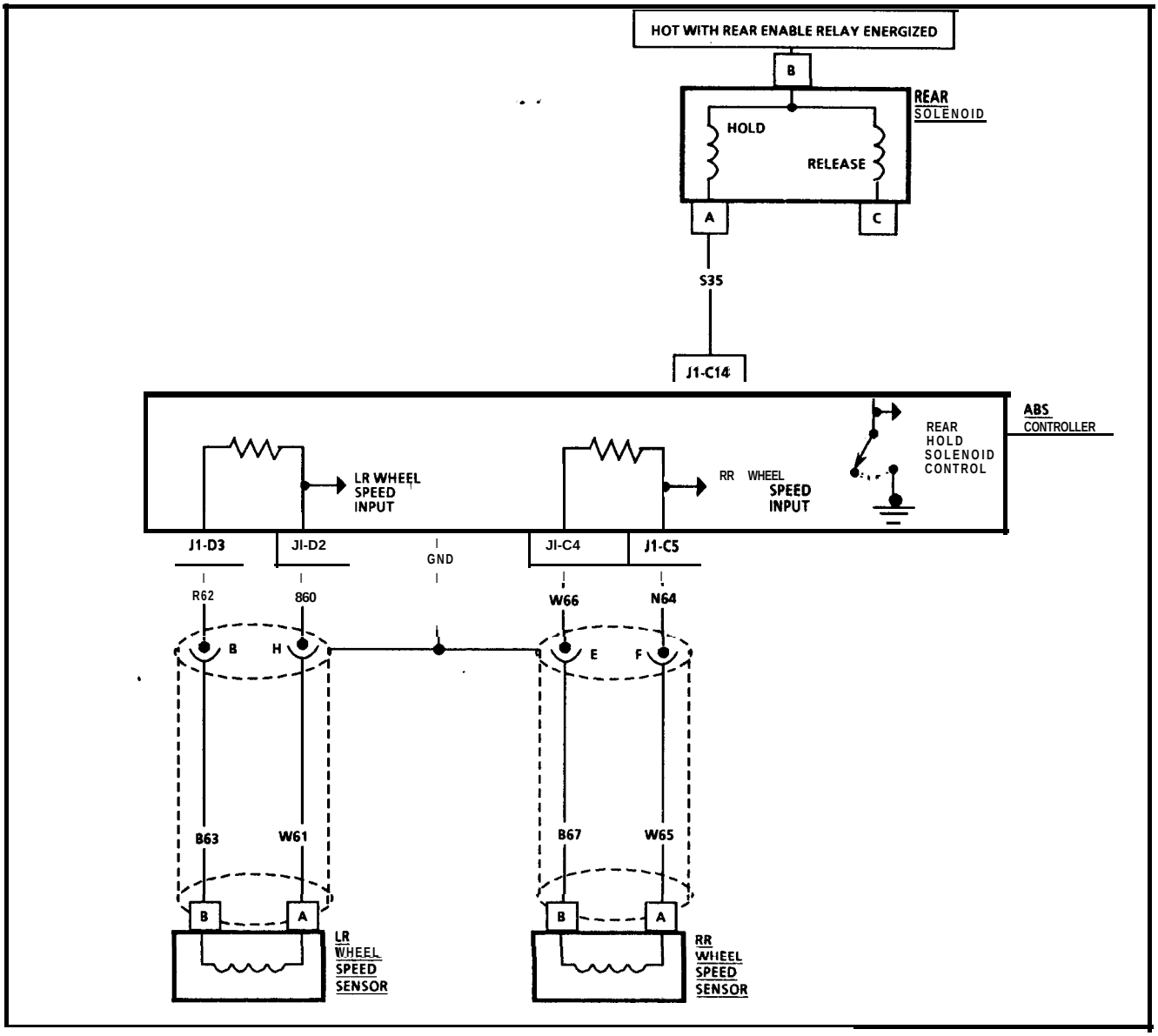
1. If any other codes are set they should be addressed first. The reason for this is that the fault that caused the solenoid to be energized too long will be better identified.
2. By examining the Left Front Wheel Speed Input, it can be determined if the fault is due to erratic wheel speed inputs which occur only at low speeds. If the wheel speed input is found to be steady at a low speed, a mechanical or hydraulic problem is indicated.

CODE A027

LEFT FRONT HOLD SOLENOID ENERGIZED TOO LONG


0 1
• IGNITION IN "RUN."
• ARE ANY OTHER CODES SET?
NO
YES
REFER TO OTHER CODES.
0 2
• ENTER DATA LIST (TECH 1 MODE FO).
• ROAD TEST VEHICLE.
• MONITOR LEFT FRONT WHEEL SPEED WHILE GRADUALLY DECELERATING FROM 25 MPH TO 0 MPH.
ERRATIC WHEEL SPEED OBSERVED, OR WHEEL SPEED SUDDENLY DROPS TO ZERO BEFORE DECREASING TO 10 MPH
CHECK WHEEL SPEED SENSOR AND SPEED RING FOR DAMAGE, PROPER MOUNTING, AND POOR ALIGNMENT. REFER TO SECTION "JF.18". IF SPEED SENSOR AND SPEED RING ARE GOOD, REPLACE ABS CONTROLLER.
STEADY WHEEL SPEED OBSERVED THAT DECREASES AT A STEADY RATE AS THE WHEEL SLOWS TO A STOP.
CHECK FOR MECHANICAL OR HYDRAULIC SYSTEM FAULT - REFER TO SECTION "JF.13". IF NO FAULT IS FOUND, AN INTERMITTENT FAULT CONDITION IN LEFT FRONT WHEEL SPEED SENSOR CIRCUIT IS INDICATED. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE, WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A028

REAR HOLD SOLENOID ENERGIZED TOO LONG

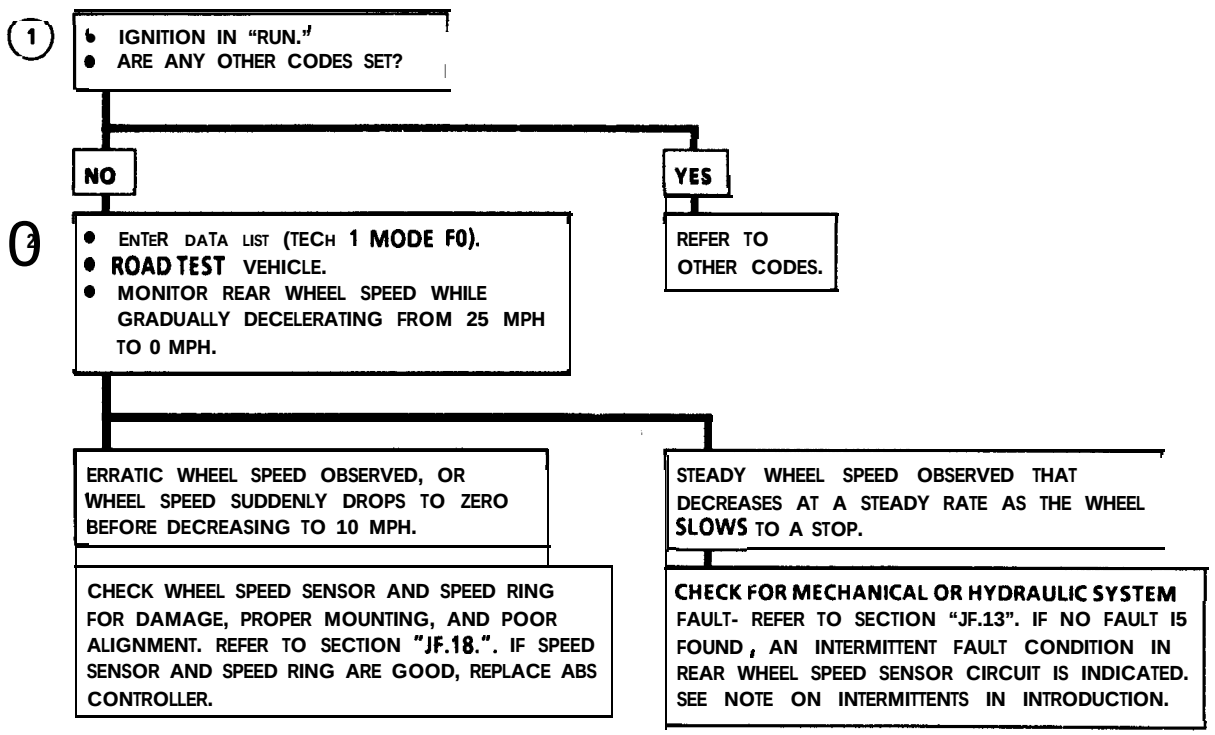
By monitoring the Rear Wheel Speed Sensors, the ABS Controller can determine if a Rear Wheel is not decelerating properly during an ABS stop. If this condition occurs, the ABS Controller will activate the Rear Hold Solenoid by closing the Rear Hold Solenoid Control. The Solenoid Control will be closed until the ABS Controller determines that the Rear Wheel has decreased to an acceptable speed.
CODE, A028 will set when the ABS Controller senses that the Rear Hold Solenoid has been energized longer than proper operation requires.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

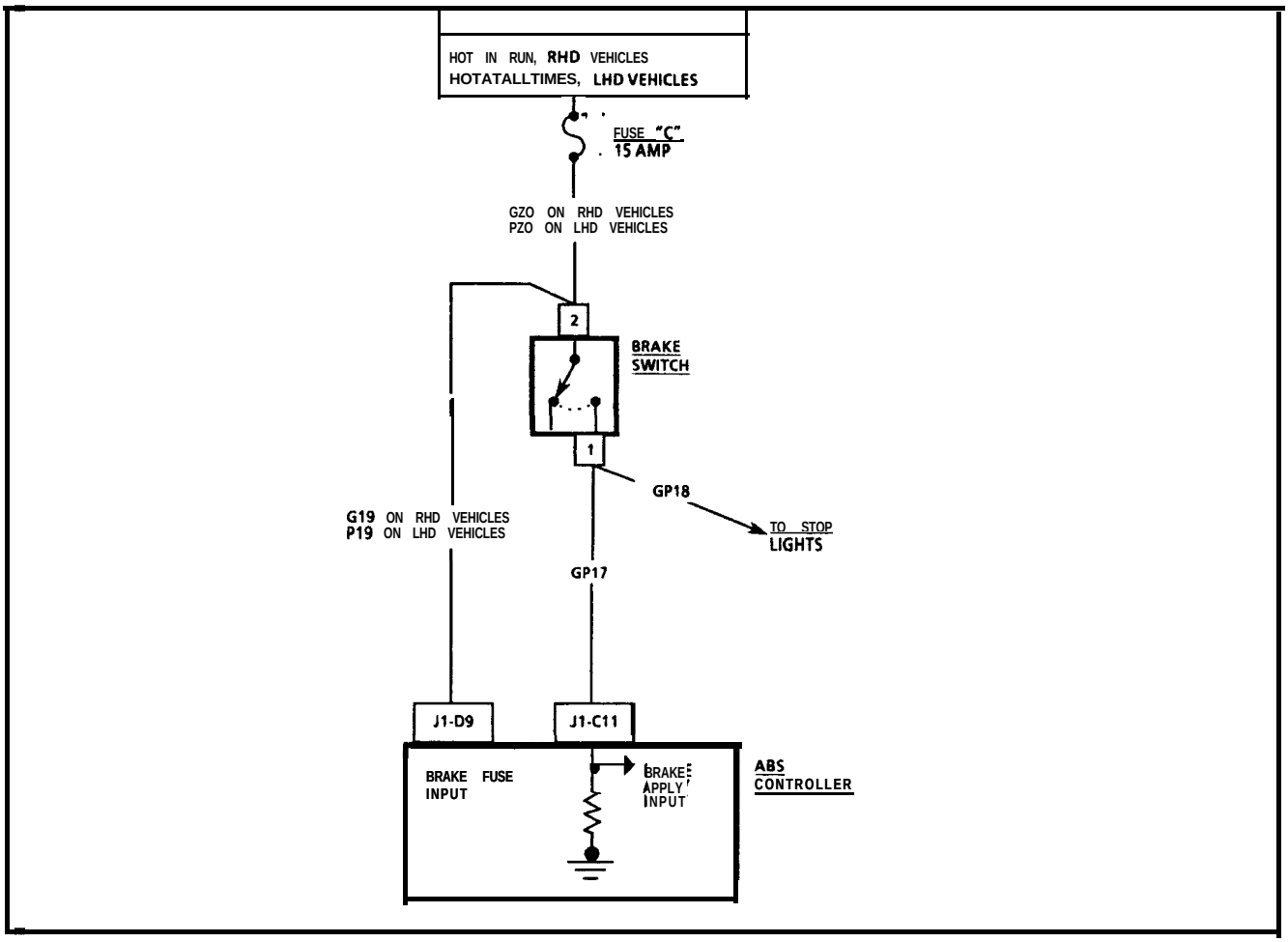
1. If any other codes are set they should be addressed first. The reason for this is that the fault that caused the solenoid to be energized too long will be better identified.
2. By examining the rear wheel speed inputs, it can be determined if the fault is due to erratic wheel speed inputs which occur only at low speeds. If the wheel speed input is found to be steady at low speed, a mechanical or hydraulic problem is indicated.

CODE A028

REAR HOLD SOLENOID ENERGIZED TOO LONG


1
IGNITION IN "RUN."
ARE ANY OTHER CODES SET?
NO
YES
REFER TO OTHER CODES.
2
ENTER DATA LIST (TECH 1 MODE F0).
ROAD TEST VEHICLE.
MONITOR REAR WHEEL SPEED WHILE GRADUALLY DECELERATING FROM 25 MPH TO 0 MPH.
ERRATIC WHEEL SPEED OBSERVED, OR WHEEL SPEED SUDDENLY DROPS TO ZERO BEFORE DECREASING TO 10 MPH.
STEADY WHEEL SPEED OBSERVED THAT DECREASES AT A STEADY RATE AS THE WHEEL SLOWS TO A STOP.
CHECK WHEEL SPEED SENSOR AND SPEED RING FOR DAMAGE, PROPER MOUNTING, AND POOR ALIGNMENT. REFER TO SECTION "JF.18.". IF SPEED SENSOR AND SPEED RING ARE GOOD, REPLACE ABS CONTROLLER.
CHECK FOR MECHANICAL OR HYDRAULIC SYSTEM FAULT- REFER TO SECTION "JF.13". IF NO FAULT I5 FOUND, AN INTERMITTENT FAULT CONDITION IN REAR WHEEL SPEED SENSOR CIRCUIT IS INDICATED. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEARCODES ANDVERIFY OPERATION.



CODE A029

BRAKE SWITCH FUSE INPUT CIRCUIT OPEN

Voltage is applied through Fuse "C" to the Brake Switch and terminal **"J1-D9"** of the ABS-Controller. Code A029 will set when the following condition exists:

- Brake Switch Fuse Input circuit is open.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. Confirms that a problem in the Brake Fuse Input CKT exists.
2. Determines if an open condition or a short to ground (blown Fuse "C", Code **A057)** exists.
3. Determines if the fault is internal of the ABS Controller.
4. Determines if the open condition is in **G19 / G20** (RHD-VEHICLES) / **P19/P20** (LHD-VEHICLES) or in N24 **(LHD-VEHICLES) / W22** (RHD-VEHICLES).

CODE A029

BRAKE SWITCH FUSE INPUT CIRCUIT OPEN

(1) ● IGNITION IN "RUN".
● ENTER DATA LIST (TECH 1 MODE FO).
● SELECT BRAKE FUSE INPUT STATE.
• IS BRAKE FUSE INPUT STATE "HIGH"?

NO

(2) . PRESS BRAKE PEDAL.
. IS BRAKE FUSE INPUT STATE "LOW" ?

NO

(3) ● RELEASE BRAKE PEDAL.
● IGNITION IN "OFF".
● DISCONNECT ABS CONTROLLER.
● IGNITION IN "RUN".
● MEASURE VOLTAGE TO GROUND ATTERMINAL "J1-D9" OF ABS CONTROLLER HARNESS CONNECTOR.

BATTERY VOLTAGE

● IGNITION IN "OFF"
● RECONNECT ABS CONTROLLER
● IGNITON IN "RUN".
● MONITOR BRAKE FUSE INPUT STATE ON TECH 1.
• IS BRAKE FUSE INPUT STATE "CIRCUIT OPEN"?

YES

REPLACE ABS CONTROLLER.

NO

CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER AND BRAKE SWITCH.

0 VOLTS

CHECK FUSE "C".

FUSE NOT BLOWN

(4) . REMOVE FUSE "C".
. MEASURE VOLTAGE TO GROUND AT HIGH SIDE OF FUSE "C" SOCKET.

BATTERY VOLTAGE

REPAIR OPEN IN G19 (RHD VEHICLES)/ P19 (LHD VEHICLES).

0 VOLTS

REPAIR OPEN IN:
a) LHD VEHICLES: "N24" BETWEEN FUSE "C" AND BATTERY
b) RHD VEHICLES: "W22" BETWEEN FUSE "C" AND SPLICE "B".

FUSE BLOWN

REPLACE FUSE "C". SYSTEM IS OK.

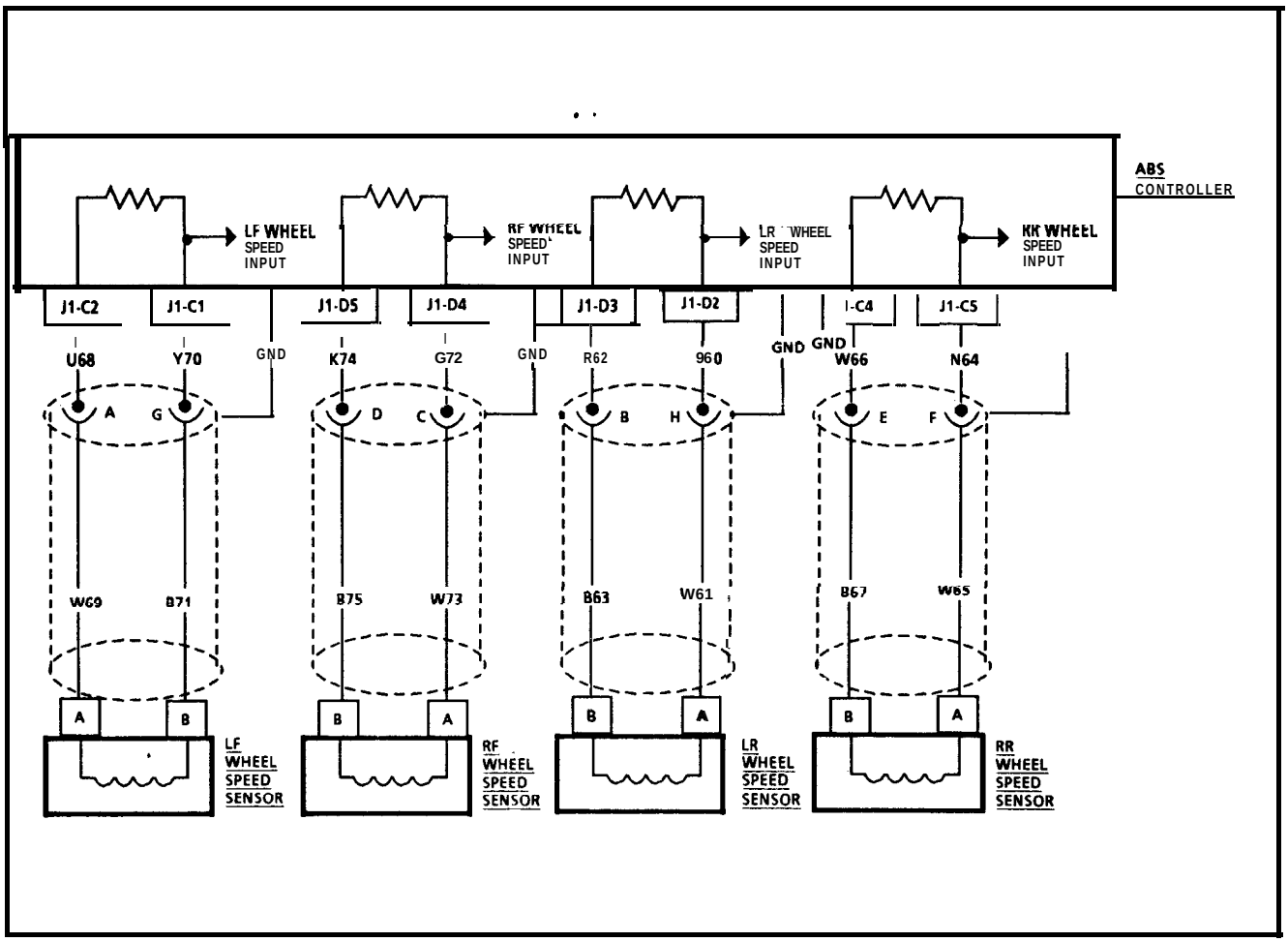
YES

FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

NO

REFER TO CODE A057.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A030

BOTH FRONT, OR ONE FRONT AND ONE REAR WHEEL SPEED SENSOR OPEN OR SHORTED TO GROUND

The ABS Controller monitors the Wheel Speed Sensors. If one or more wheel speed inputs are not receiving data from the Wheel Speed Sensor, the Controller cannot detect wheel lockup. When only one speed input is not receiving data, Code A044, A045, A046 or A047 will be set. This Code (A030) is set when more than one speed input is faulty.

CODE A030 will set when the ABS Controller senses that either both Front Wheel Speed Sensors or both a Front and a Rear Wheel Speed Sensor input are 0 mph for greater than 20 seconds.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. By observing all four Wheel Speed Sensor inputs (while driving vehicle), you can determine which Wheel Speed Sensor circuits are faulty (no wheel speed observed).

Faults can be diagnosed by refering to Codes A044, A045, A046, and A047 (right front, left front, right rear or left rear wheel speed = 0). In the case where an intermittent fault condition is indicated refer to introduction,

CODE A030

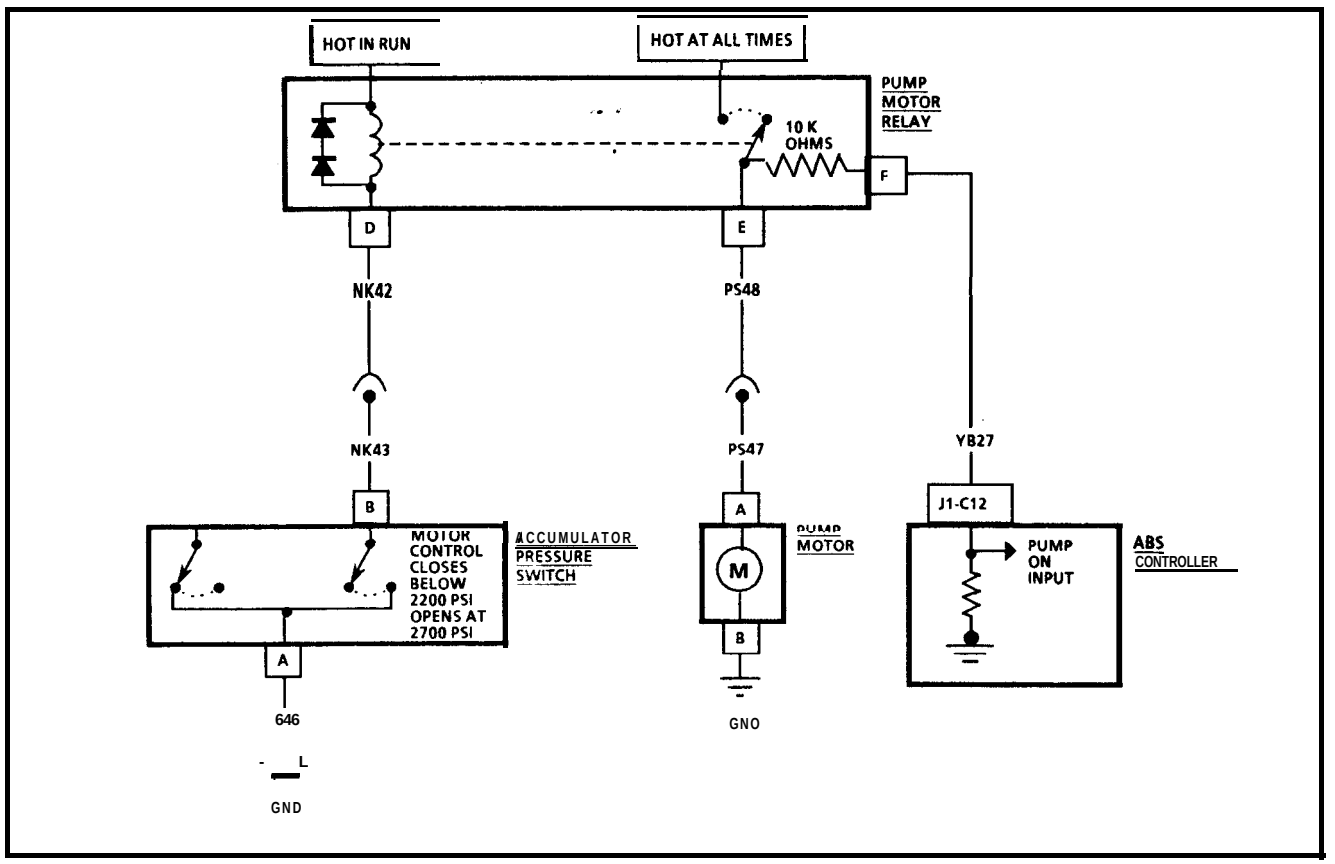
BOTH FRONT, OR ONE FRONT AND ONE REAR WHEEL SPEED SENSOR OPEN OR SHORTED TO GROUND

0 (1)

- IGNITION IN "RUN."
- ENTER DATA LIST (TECH 1 MODE FO).
- DRIVE VEHICLE AT 30 MPH AND OBSERVE WHEEL SPEED DATA.

NO WHEEL SPEED OBSERVED ON AT LEAST TWO OF THE SENSOR INPUTS.	NO WHEEL SPEED OBSERVED ON ONE WHEEL SPEED SENSOR INPUT. OTHER THREE WHEEL SPEEDS PRESENT.	WHEEL SPEED OBSERVED ON ALL WHEEL SPEED INPUTS.
REFER TO CODE A044 OR A045 (RIGHT OR LEFT FRONT WHEEL SPEED = 0) TO DIAGNOSE THE FRONT WHEEL SPEED SENSOR(S) WHICH HAD NO WHEEL SPEED OBSERVED. REFER TO CODE A046 OR A047 (RIGHT OR LEFT REAR WHEEL SPEED = 0) TO DIAGNOSE FAULT WITH REAR WHEEL SPEED SENSOR WHICH HAD NO WHEEL SPEED OBSERVED.	REFER TO EITHER CODE A044, A045, A046, OR A047 TO DIAGNOSE WHEEL SPEED SENSOR WHICH HAD NO WHEEL SPEED OBSERVED. AN INTERMITTENT FAULT CONDITION IS INDICATED IN ONE OF THE OTHER WHEEL SPEED SENSORS. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.	FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A031

OPEN PUMP MOTOR FEEDBACK CIRCUIT

Whenever the Pump Motor Relay contacts are open, the Pump On Input is grounded through the Pump Motor Relay and the Pump Motor. The Pump On Input will have voltage applied to it when the Pump Motor Relay Contacts are closed (the Pump Motor also has voltage applied to it). If the Pump On Input does not sense ground or the proper voltage, the ABS Controller will set Code A031.
CODE A031 will set when the ABS Controller detects an open condition in the Pump Motor circuit between the Pump Motor Relay and ground or detects an open condition in the Pump On Input circuit between the Pump Motor Relay and the ABS Controller.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. If Code A036 is also set, the problem is isolated to poor connections at either the Pump Motor Relay or connection to the ABS Controller terminal "Jl-C12".
2. Code A035, when set with Code A031, indicates that the Pump Motor circuit is open.
3. This step determines if the Pump Motor Feedback circuit is open.
4. If the Pump Motor State is always on, there must be an open in the Pump Motor circuit which is preventing the Pump Motor from operating.
5. Determines if the open condition exists in CKT between the Pump Motor and ground.
6. Battery voltage at terminal **"J1-C12"** indicates a problem with the connection at the Controller or the Controller itself.
7. Detects if circuit to Pump Motor is good. This would indicate a faulty Pump Motor.
8. Determines that the open condition is internal to the Pump Motor Relay if the resistance across Terminals "E" and **"F"** of the Pump Motor Relay is infinite.

CODE A031
OPEN PUMP MOTOR FEEDBACK CIRCUIT

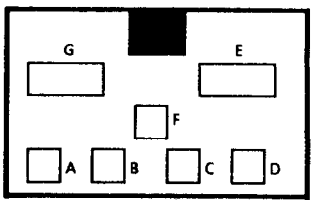
1. • IGNITION IN "RUN."
   • IS CODE A036 ALSO SET?
   - NO → 2
   - YES → CHECK ABS CONTROLLER HARNESS CONNECTOR TERMINAL "J1-C12" AND PUMP MOTOR RELAY CONNECTOR FOR GOOD CONTACT.

2. . IS CODE A035 ALSO SET?
   - NO → 3
   - YES

3. • ENTER DATA LIST (TECH 1 MODE FG).
   . OBSERVE PUMP MOTOR STATE.
   • PUMP BRAKES (APPROX 25 TIMES).
   . IS PUMP MOTOR STATE: CIRCUIT OPEN?
   - NO → PUMP MOTOR STATE "ON" CONSTANTLY. FAULT IS NOT PRESENT. . . SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
   - YES → 6

6. • IGNITION "OFF."
   . DISCONNECT ABS CONTROLLER.
   • IGNITION IN "RUN."
   . PUMP BRAKES UNTIL PUMP MOTOR TURNS "ON."
   . WITH PUMP MOTOR RUNNING MEASURE VOLTAGE AT TERMINAL "J1-C12" OF ABS CONTROLLER HARNESS CONNECTOR TO GROUND.
   - 0 VOLTS → 8
   - LESS THAN BATTERY VOLT → CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER. IF CONTACT IS GOOD, REPLACE ABS CONTROLLER.

8. . IGNITION IN "OFF".
   . DISCONNECT PUMP MOTOR RELAY.
   • MEASURE RESISTANCE BETWEEN TERMINALS "E" AND "F" OF PUMP MOTOR RELAY.
   - APPROX 10,000 OHMS → REPAIR OPEN IN YB27.
   - INFINITE OHMS → REPLACE PUMP MOTOR RELAY.



PUMP MOTOR RELAY

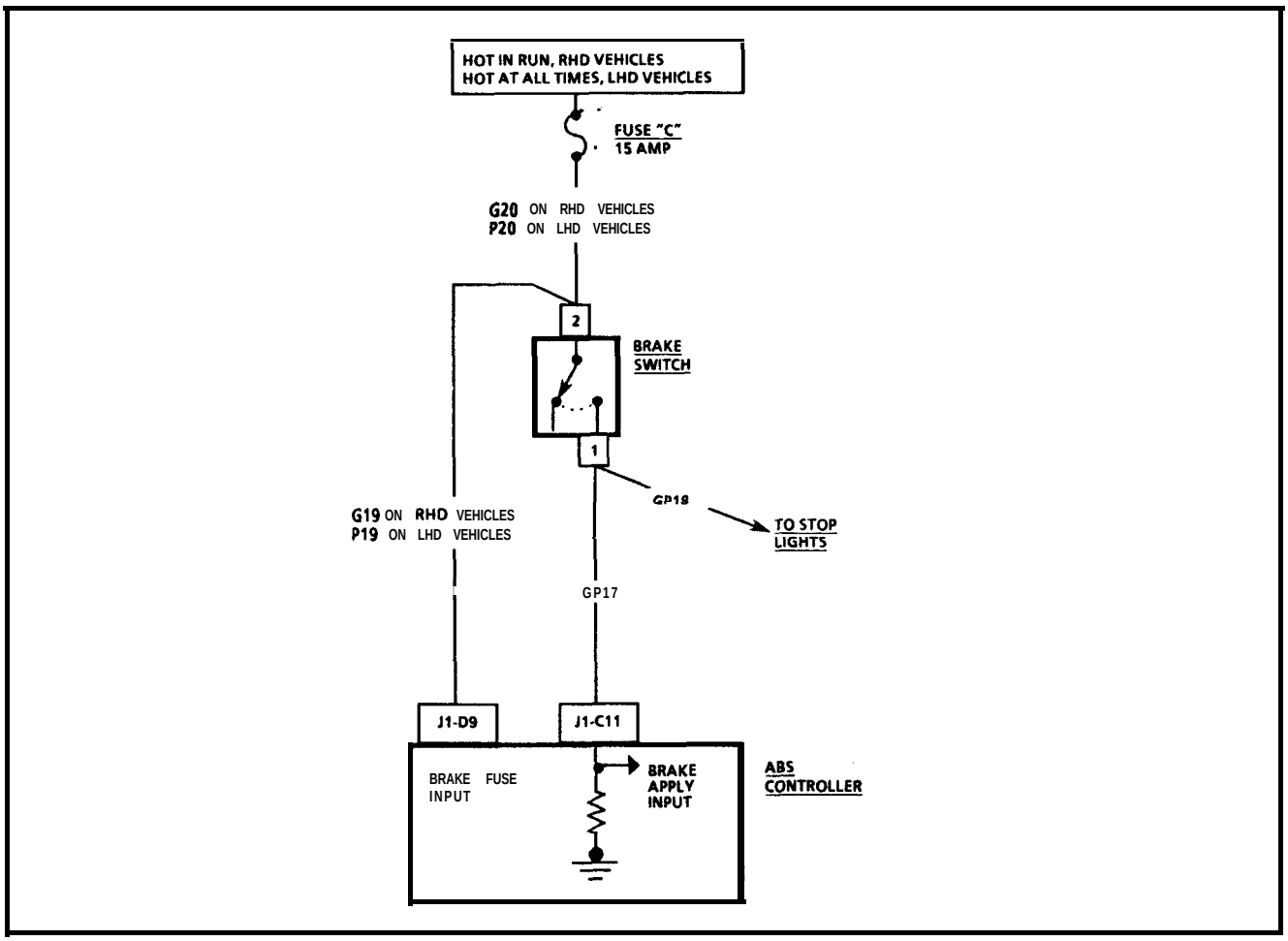
4. . OBSERVE PUMP MOTOR STATE FOR 40 SECONDS. DO NOT PUMP BRAKES.
   . CHECK PUMP MOTOR STATE, WHEN PUMP MOTOR IS NOT RUNNING.
   - PUMP MOTOR STATE "OFF" → FAULT IS NOT PRESENT. . . SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
   - PUMP MOTOR STATE "ON" CONSTANTLY. → 5

5. • IGNITION "OFF."
   . DISCONNECT PUMP MOTOR.
   . MEASURE RESISTANCE TO GROUND FROM TERMINAL B OF THE PUMP MOTOR HARNESS CONNECTOR.
   - 10 OHMS → 3
   - INFINITE OHMS → REPAIR OPEN IN CONNECTION TO GROUND.

3. . IGNITION IN "RUN".
   • CONNECT VOLTMETER BETWEEN TERMINAL "A" OF PUMP MOTOR HARNESS CONNECTOR AND GROUND.
   • ENTER DATA LIST (TECH 1 MODE F0).
   • SELECT BRAKE PRESSURE STATE.
   • PUMP BRAKES UNTIL BRAKE PRESSURE STATE IS "LOW (< 1800 PSI)".
   . READ VOLTMETER.
   - 0 VOLTS → 8
   - BATTERY VOLTAGE → CHECK FOR POOR TERMINAL CONTACT AT PUMP MOTOR. IF CONTACT IS GOOD, REPLACE PUMP MOTOR.

8. • IGNITION IN "OFF".
   • DISCONNECT PUMP MOTOR RELAY.
   • MEASURE RESISTANCE BETWEEN TERMINALS "E" AND "F" OF PUMP MOTOR RELAY.
   - APPROX 10,000 OHMS → REPAIR OPEN IN PS47, PS48.
   - INFINITE OHMS → REPLACE PUMP MOTOR RELAY.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A032

OPEN BRAKE SWITCH OR HYDRAULIC LEAK

Voltage is applied to the Brake Switch. When the Brake Switch is closed, voltage is applied to the Stop Lights and terminal "J1-C11" of the ABS Controller. If the Brake Apply Input receives voltage, the Controller determines that the brakes are being applied.

CODE A032 will set when all of the following conditions exist:

- The ABS Controller receives three pump on inputs without receiving a brake switch on input. This allows a brake switch fault to be detected without an Antilock Braking condition present.

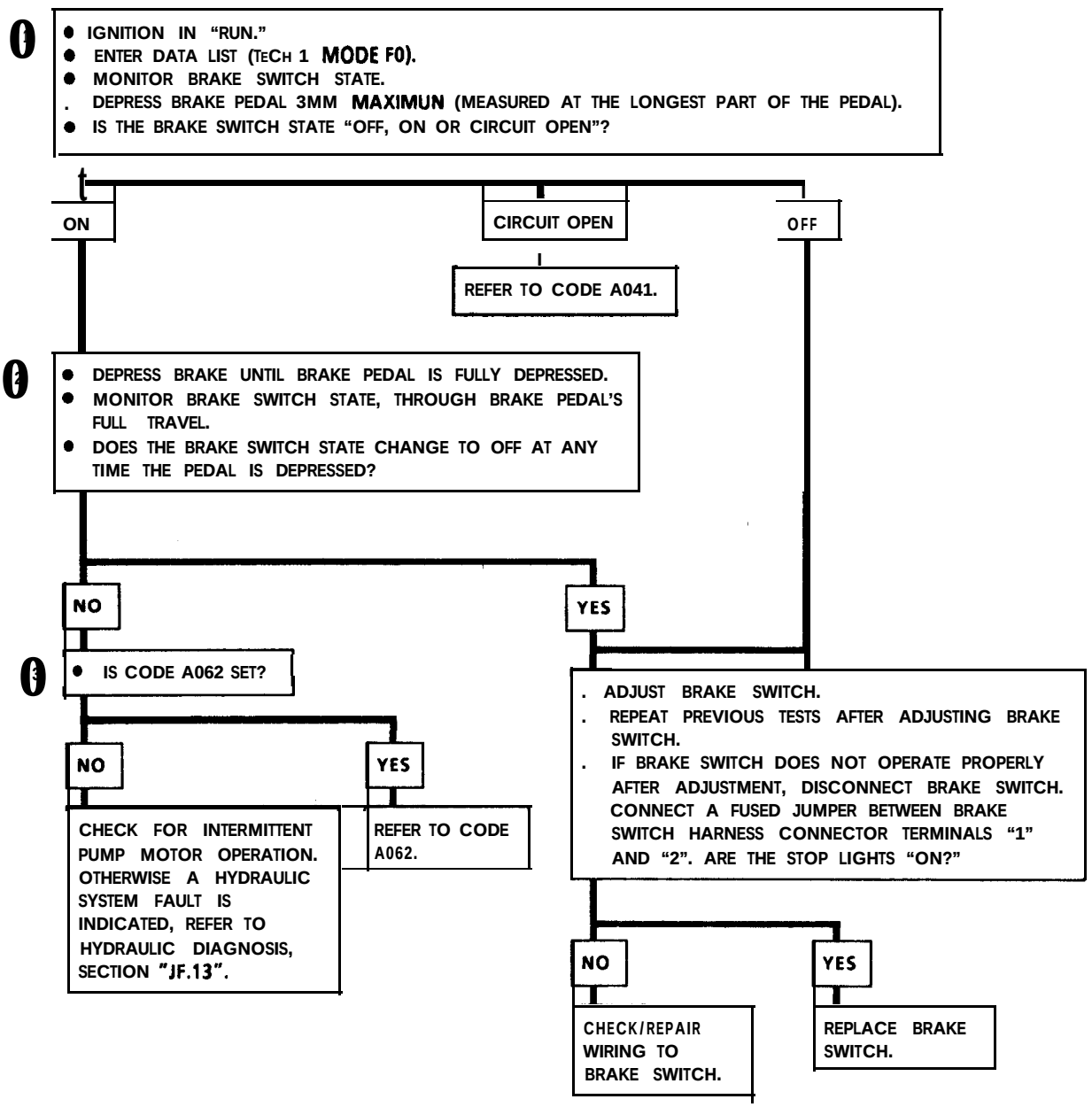
Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. & 2. Checks for an improperly adjusted or intermittent Brake Switch.

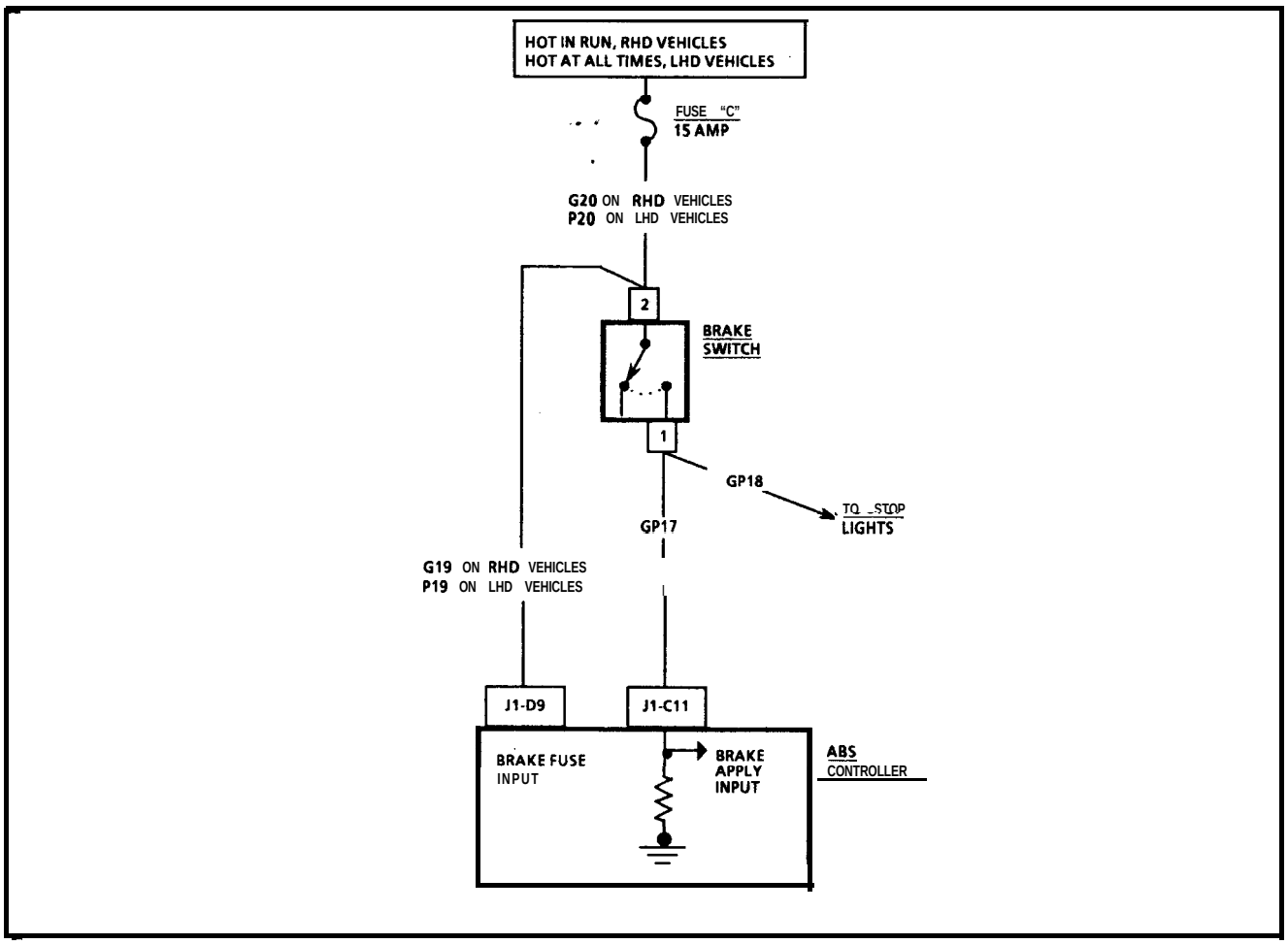
3. If Code A062 is also set, the pump motor was cycling too fast. See Code A062.

CODE A032

OPEN BRAKE SWITCH OR HYDRAULIC LEAK


0
• IGNITION IN "RUN."
• ENTER DATA LIST (TECH 1 MODE F0).
• MONITOR BRAKE SWITCH STATE.
. DEPRESS BRAKE PEDAL 3MM MAXIMUN (MEASURED AT THE LONGEST PART OF THE PEDAL).
• IS THE BRAKE SWITCH STATE "OFF, ON OR CIRCUIT OPEN"?
ON
CIRCUIT OPEN
OFF
REFER TO CODE A041.
0
• DEPRESS BRAKE UNTIL BRAKE PEDAL IS FULLY DEPRESSED.
• MONITOR BRAKE SWITCH STATE, THROUGH BRAKE PEDAL'S FULL TRAVEL.
• DOES THE BRAKE SWITCH STATE CHANGE TO OFF AT ANY TIME THE PEDAL IS DEPRESSED?
NO
YES
0
• IS CODE A062 SET?
NO
YES
CHECK FOR INTERMITTENT PUMP MOTOR OPERATION. OTHERWISE A HYDRAULIC SYSTEM FAULT IS INDICATED, REFER TO HYDRAULIC DIAGNOSIS, SECTION "JF.13".
REFER TO CODE A062.
. ADJUST BRAKE SWITCH.
. REPEAT PREVIOUS TESTS AFTER ADJUSTING BRAKE SWITCH.
. IF BRAKE SWITCH DOES NOT OPERATE PROPERLY AFTER ADJUSTMENT, DISCONNECT BRAKE SWITCH. CONNECT A FUSED JUMPER BETWEEN BRAKE SWITCH HARNESS CONNECTOR TERMINALS "1" AND "2". ARE THE STOP LIGHTS "ON?"
NO
YES
CHECK/REPAIR WIRING TO BRAKE SWITCH.
REPLACE BRAKE SWITCH.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A033

BRAKE SWITCH OPEN

Voltage is applied to the Brake Switch. When the Brake Switch is closed, voltage is applied to the Stop Lights and terminal "Jl-Cll" of the ABS Controller. If the Brake Apply Input receives voltage, the ABS Controller determines that the brakes are being applied.

CODE A033 will set when all of the following conditions exist:

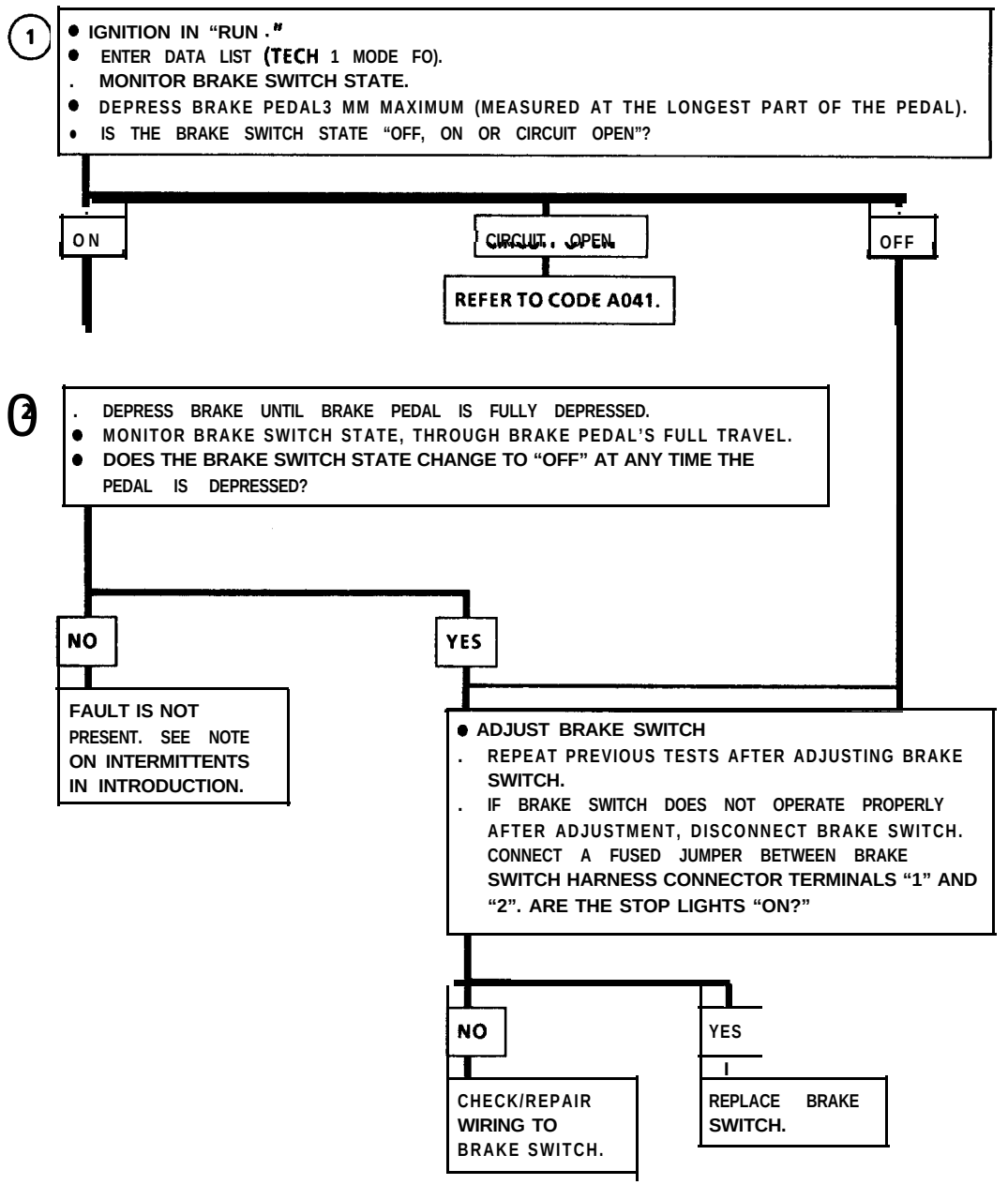
- The ABS Controller senses no voltage at terminal "Jl-Cll" (brake apply input is low).
- The ABS Controller senses that two wheels (one of which is in the front) are decelerating at a rate greater than normally possible without using the brakes (vehicle is slowing down fast enough that the controller knows the brakes are being applied).

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

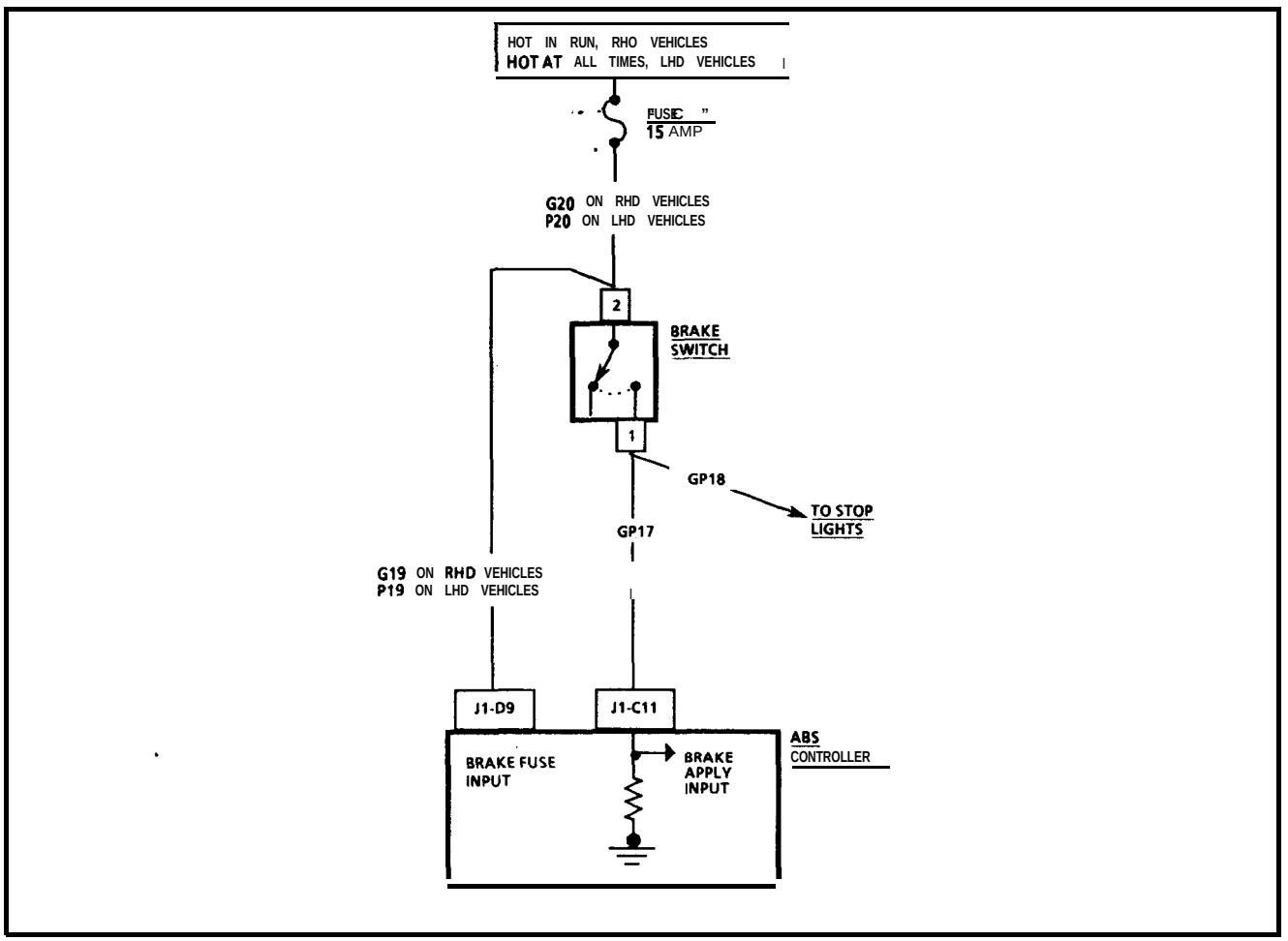
1. & 2. Checks for improperly adjusted or intermittent Brake Switch.

CODE A033

BRAKE SWITCH OPEN


1
• IGNITION IN "RUN."
• ENTER DATA LIST (TECH 1 MODE FO).
. MONITOR BRAKE SWITCH STATE.
• DEPRESS BRAKE PEDAL3 MM MAXIMUM (MEASURED AT THE LONGEST PART OF THE PEDAL).
• IS THE BRAKE SWITCH STATE "OFF, ON OR CIRCUIT OPEN"?
ON
CIRCUIT. OPEN
OFF
REFER TO CODE A041.
2
. DEPRESS BRAKE UNTIL BRAKE PEDAL IS FULLY DEPRESSED.
• MONITOR BRAKE SWITCH STATE, THROUGH BRAKE PEDAL'S FULL TRAVEL.
• DOES THE BRAKE SWITCH STATE CHANGE TO "OFF" AT ANY TIME THE PEDAL IS DEPRESSED?
NO
YES
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
• ADJUST BRAKE SWITCH
. REPEAT PREVIOUS TESTS AFTER ADJUSTING BRAKE SWITCH.
. IF BRAKE SWITCH DOES NOT OPERATE PROPERLY AFTER ADJUSTMENT, DISCONNECT BRAKE SWITCH. CONNECT A FUSED JUMPER BETWEEN BRAKE SWITCH HARNESS CONNECTOR TERMINALS "1" AND "2". ARE THE STOP LIGHTS "ON?"
NO
YES
CHECK/REPAIR WIRING TO BRAKE SWITCH.
REPLACE BRAKE SWITCH.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A034

BRAKE SWITCH SHORTED

When the Brake Pedal is depressed, the Brake Switch closes. This applies voltage from the Stop Fuse "C" to the ABS Controller and the Stop Lights. Before the ABS Controller will initiate an Antilock Brake Stop, it must first sense voltage at the Brake Apply Input.

CODE A034 will set when all of the following conditions exist:

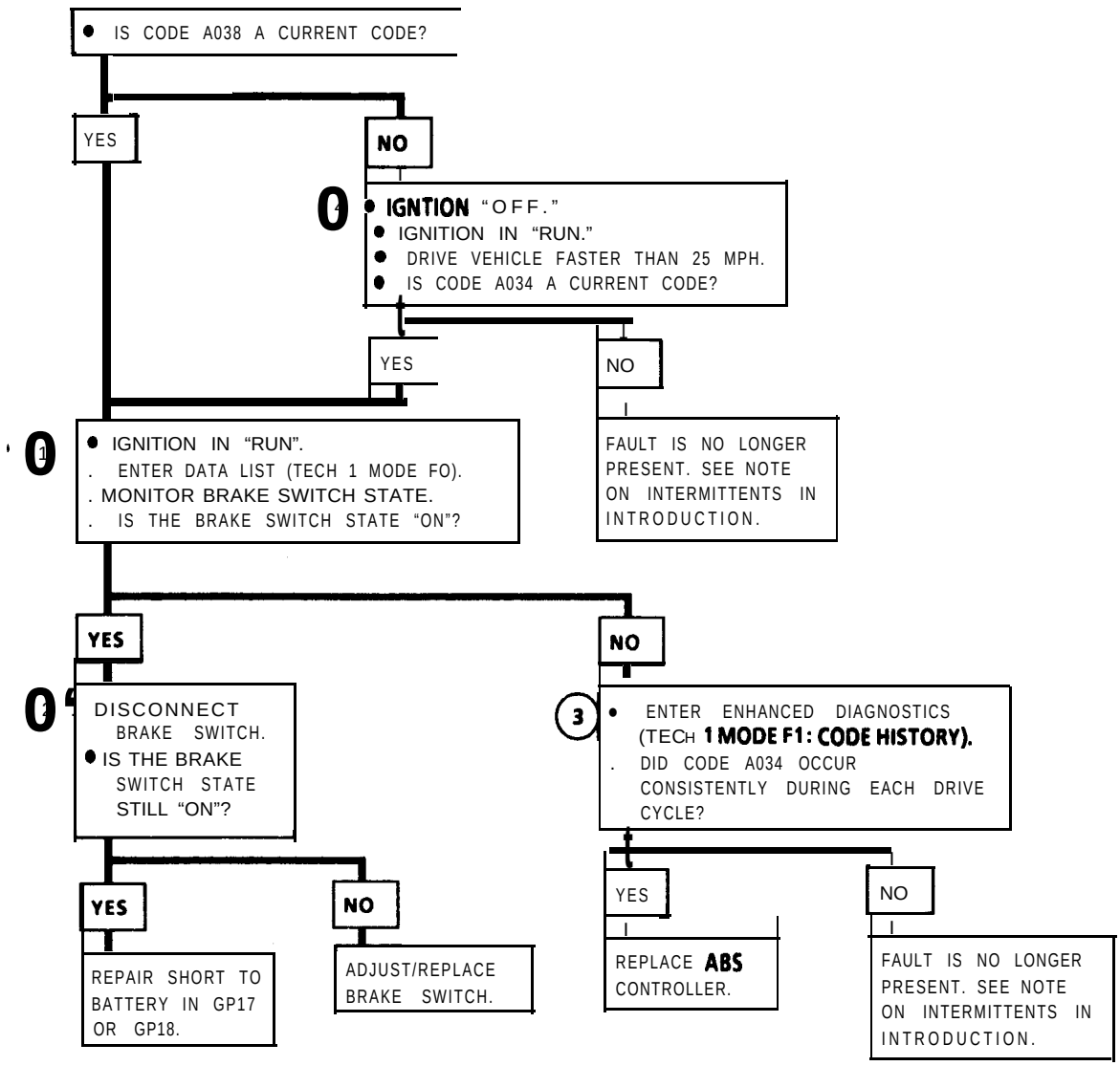
- The ABS Controller senses battery voltage at terminal "J1C-11" for a complete ignition cycle in which the vehicle speed surpasses 25 mph.
- The ABS Controller senses battery voltage at terminal "J1C-11" during any following ignition cycle in which the vehicle speed surpasses 25 mph.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

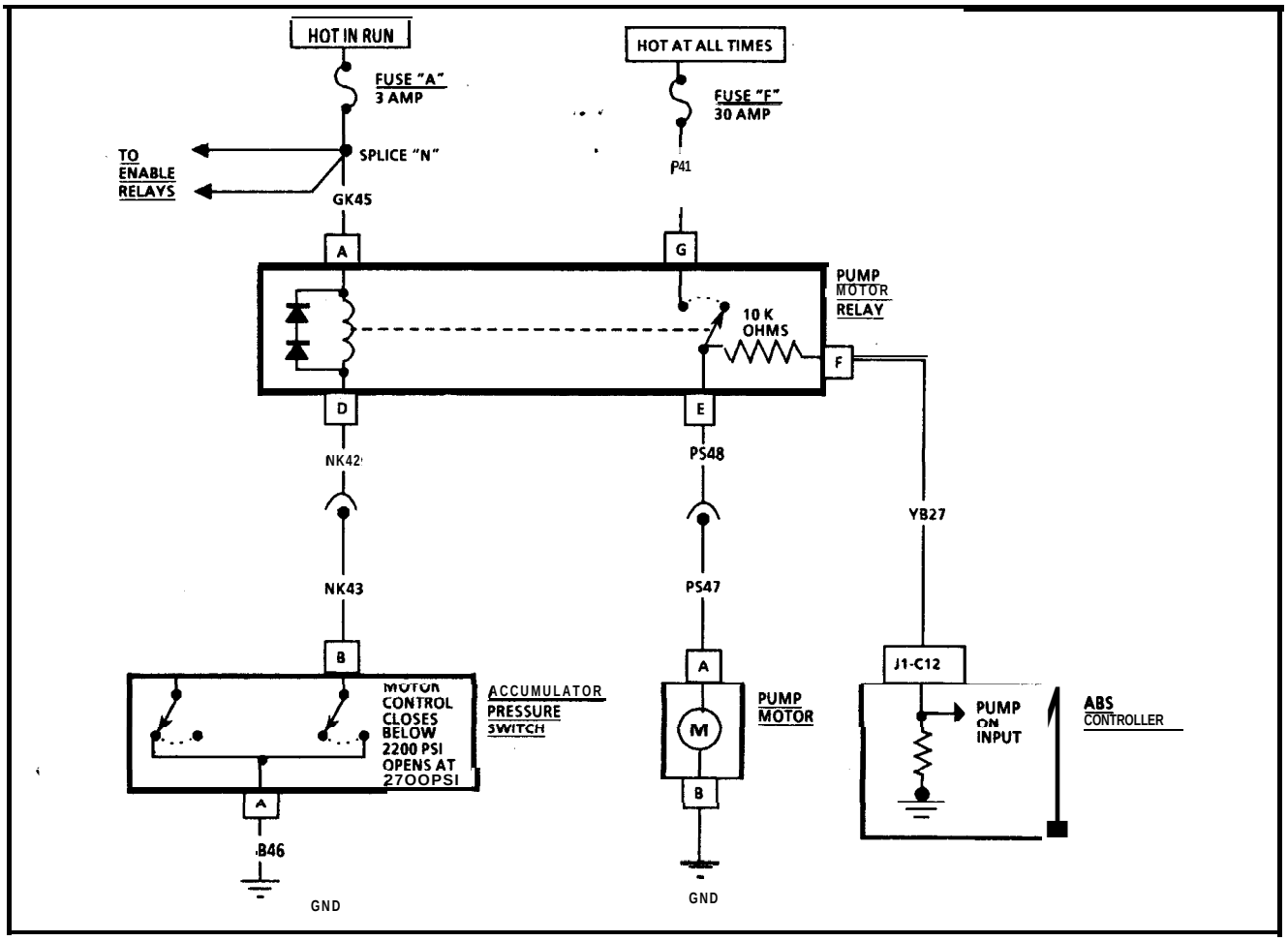
1. Confirms that a short exists in the circuit (brake lights on).
2. Determines whether a short to Battery exists in the GP17 or GP18 or whether the Brake Switch is shorted or maladjusted.
3. If Code A034 is a consistent failure, but CKTS and Brake Switch are good, the ABS Controller must have an internal fault.
4. This step verifies that the code is not about to become a current code by passing the second condition (see above).

CODE A034

BRAKE SWITCH SHORTED


• IS CODE A038 A CURRENT CODE?
YES
NO
0
• IGNTION "OFF."
• IGNITION IN "RUN."
• DRIVE VEHICLE FASTER THAN 25 MPH.
• IS CODE A034 A CURRENT CODE?
YES
NO
FAULT IS NO LONGER PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
0
• IGNITION IN "RUN".
. ENTER DATA LIST (TECH 1 MODE FO).
. MONITOR BRAKE SWITCH STATE.
. IS THE BRAKE SWITCH STATE "ON"?
YES
NO
0
DISCONNECT BRAKE SWITCH.
• IS THE BRAKE SWITCH STATE STILL "ON"?
3
• ENTER ENHANCED DIAGNOSTICS (TECH 1 MODE F1: CODE HISTORY).
. DID CODE A034 OCCUR CONSISTENTLY DURING EACH DRIVE CYCLE?
YES
NO
REPAIR SHORT TO BATTERY IN GP17 OR GP18.
ADJUST/REPLACE BRAKE SWITCH.
YES
NO
REPLACE ABS CONTROLLER.
FAULT IS NO LONGER PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A035

PUMP MOTOR RUNNING TOO LONG

The Accumulator Switch Motor Control closes when the pressure drops below 2200 PSI. This grounds the Pump Motor Relay Coil causing voltage to be applied to the Pump Motor and Pump On Input. Whenever the Pump Motor is on, the Pump On Input will have voltage applied to it.
CODE A035 will set when the ABS Controller senses voltage at Terminal "J1-C12" "Pump on input" for more than 3 minutes

.Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. When Code A035 and A031 are both set, the problem is isolated to the Pump Motor Circuit.
2. This step determines if the Pump Motor is running constantly (electrical fault), running longer than normal (hydraulic fault), or running too long intermittently.
3. It can be determined if the accumulator switch is causing the fault by disconnecting the accumulator switch and observing the Pump Motor State.
4. Determines if a short to ground exists in NK42, NK43 wire.
5. This step detects if a short to Battery exists by isolating the YB27 wire and ABS Controller from the Pump Motor Circuit.
6. Determines if a short to Battery exists in the PS47 or PS48 wire, or whether the Pump Motor Relay is defective.

CODE A035

PUMP MOTOR RUNNING TOO LONG

(1) • IGNITION IN "RUN."
• IS CODE A031 ALSO SET?

NO

YES → REFER TO CODE A031.

(2) . PERFORM NORMAL PUMP RUN CYCLE TEST:
• START AT TECH 1 MAIN MENUE
• SELECT F4: ABS TESTS
• SELECT F3: PUMP MOTOR
• SELECT FO: RUN CYCLE
• FOLLOW TECH 1 DIRECTIONS.

DISPLAY SHOWS:
"PUMP RUN TIMER • * PUMP RUNNING • * WAIT FOR PUMP TO STOP".
TECH 1 DOES NOT START TEST.

BOTH PUMP RUN TIMES ARE LESS THAN 10 SECONDS. → FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

AT LEAST ONE PUMP RUN TIME LONGER THAN 10 SECONDS. → HYDRAULIC SYSTEM FAULT IS INDICATED. REFER TO SECTION "JF.13".

(3) • ENTER DATA LIST (TECH 1 MODE F0).
• SELECT PUMP MOTOR STATE.
• DISCONNECT ACCUMULATOR PRESSURE SWITCH.
• OBSERVE PUMP MOTOR STATE.
• IS PUMP MOTOR STATE "ON"?

YES

NO → CHECK FOR HYDRAULIC SYSTEM PROBLEM (REFER TO SECTION "JF.13"). IF NO PROBLEM IS FOUND, REPLACE ACCUMULATOR SWITCH.

(4) • MEASURE VOLTAGE TO GROUND AT TERMINAL "B" OF ACCUMULATOR PRESSURE SWITCH HARNESS CONNECTOR.

BATTERY VOLTAGE

0 VOLTS → REPAIR SHORT TO GROUND IN "NK42, NK43" OR PUMP MOTOR RELAY COIL.

(5) . DISCONNECT PUMP MOTOR RELAY.
. OBSERVE PUMP MOTOR STATE.
• IS PUMP MOTOR STATE "ON"?

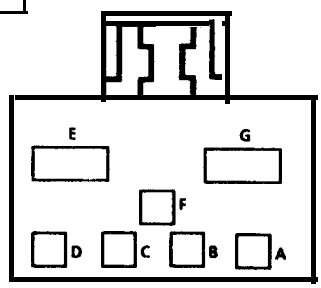
NO

YES → CHECK FOR SHORT TO BATTERY IN "YB27". IF CKT "YB27" IS GOOD REPLACE ABS CONTROLLER.

(6) . MEASURE VOLTAGE AT TERMINAL "E" OF PUMP MOTOR RELAY HARNESS CONNECTOR.

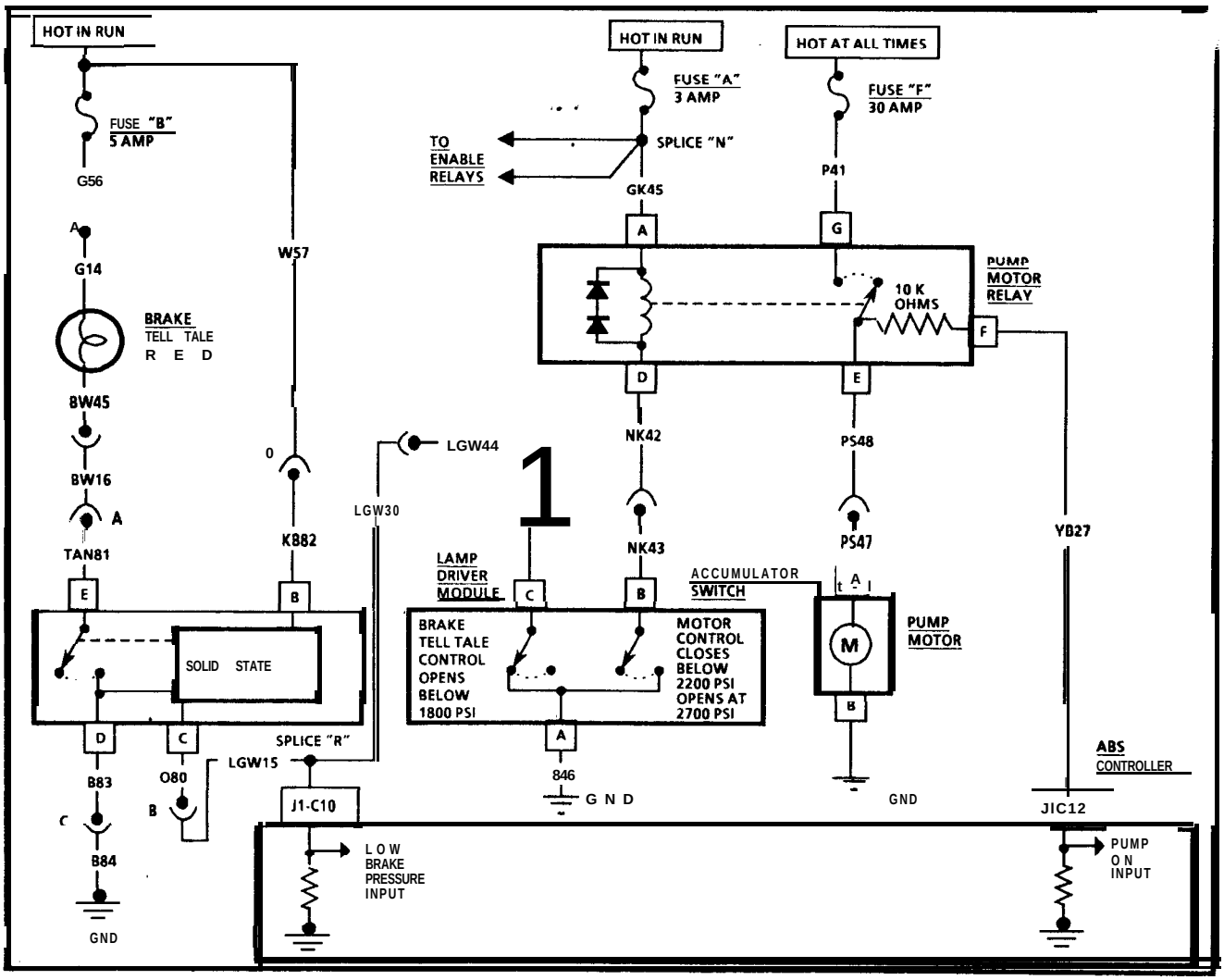
BATTERY VOLTAGE → REPAIR SHORT TO BATTERY IN PS47 OR PS48.

0 VOLTS → REPLACE PUMP MOTOR RELAY.



PUMP MOTOR RELAY HARNESS CONNECTOR

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE **A036**

PUMP MOTOR WILL NOT RUN

The pump On Input will have voltage applied to it when the Pump Motor Relay contacts are closed. If the Brake Pressure drops below 1800 psi, the Accumulator Switch opens. This removes ground from the Lamp Driver Module. The Lamp Driver Module then closes the switch to turn on the Brake Tell Tale, and also applies voltage to the Low Brake Pressure Input of the ABS Controller.
Code A036 will set when all of the following conditions exist:

- The ABS Controller does not sense voltage at Terminal "J1-C12" (Pump on input).
- The ABS Controller senses voltage at Terminal "J1-C10" (Brake Tell Tale is on).

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. If Code A036 is also set, the problem is isolated to poor connections at either the Pump Motor Relay or connection of Pump Motor to GND.
2. By observing if the Pump Motor operates, the fault is isolated to either the Low Pressure Circuit or Pump Motor Relay Circuit.
3. Determines if fault is in Pump Motor Relay Circuit or Accumulator Switch Circuit.
4. This step checks if there is an actual fault present.
5. Battery voltage at Terminal "A" indicates a good Relay Coil power feed.
6. If Pump Motor operates, the fault is either a hydraulic system failure or faulty Accumulator Switch.
7. Checks for an open circuit between Accumulator Switch and ABS Controller terminal "J1-C10".
8. Determines if NK42, NK43 are open.
9. At this point, a good Relay Contact power feed indicates a faulty Pump Motor Relay.

CODE A036

PUMP MOTOR WILL NOT RUN

1 • IGNITION IN "RUN."
• IS CODE A031 ALSO SET?

NO

2 • ENTER DATA **LIST** (TECH **1 MODE F0).**
. MONITOR PUMP MOTOR STATE WHILE PUMPING BRAKES.
• DOES PUMP MOTOR STATE TURN "ON?"

NO

3 • DISCONNECT ACCUMULATOR PRESSURE SWITCH.
• JUMPER TERMINAL B OF ACCUMULATOR PRESSURE SWITCH HARNESS CONNECTOR TO GROUND.
. MONITOR PUMP MOTOR STATE ON TECH 1.

PUMP MOTOR STATE "OFF"

5 • JUMPER STILLCONNECTED.
• DISCONNECT PUMP MOTOR RELAY.
• MEASURE VOLTAGE TO GROUND AT TERMINAL "A" OF PUMP MOTOR RELAY HARNESS CONNECTOR.

BATTERY VOLTAGE

8 • JUMPER STILL CONNECTED.
• MEASURE VOLTAGE BETWEEN TERMINALS "A" AND "D" OF PUMP MOTOR RELAY HARNESS CONNECTOR.

BATTERY VOLTAGE

9 . MEASURE VOLTAGE TO GROUND AT TERMINAL "G" OF PUMP MOTOR RELAY HARNESS CONNECTOR.

BATTERY VOLTAGE

REPLACE PUMP MOTOR RELAY.

0 VOLTS

CHECK FUSE "F" AND P41, N24.

0 VOLTS

REPAIR OPEN IN NK42, NK43.

REPAIR OPEN IN GK45 BETWEEN RELAY AND SPLICE "N".

PUMP MOTOR STATE "ON"

6 . CONNECT FUSED JUMPER BETWEEN TERMINALS "B" AND "A" OF ACCUMULATOR PRESSURE SWITCH HARNESS CONNECTOR.
. OBSERVE PUMP MOTOR STATE ON TECH 1.

PUMP MOTOR STATE "ON."

CHECK FOR HYDRAULIC SYSTEM PROBLEM (REFER TO SECTION **"JF.13").** IF NO PROBLEM FOUND, REPLACE ACCUMULATOR SWITCH.

PUMP MOTOR STATE "OFF."

REPAIR OPEN IN **"B46".**

YES

CHECK CONNECTION OF PUMP MOTOR TO GROUND AND PUMP MOTOR RELAY CONNECTOR FOR GOOD CONTACT.

YES

4 . OBSERVE BRAKE PRESSURE STATE ON TECH 1, WHEN PUMP MOTOR HAS BEEN TURNED OFF.

BRAKE PRESSURE **LOW**

7 . DISCONNECT ACCUMULATOR PRESSURE SWITCH.
• JUMPER TERMINAL "C" OF ACCUMULATOR PRESSURE SWITCH HARNESS CONNECTOR TO GROUND.
• OBSERVE BRAKE PRESSURE STATE ON TECH 1.

BRAKE PRESSURE LOW

REPAIR OPEN IN **LGW30,** LGW44".

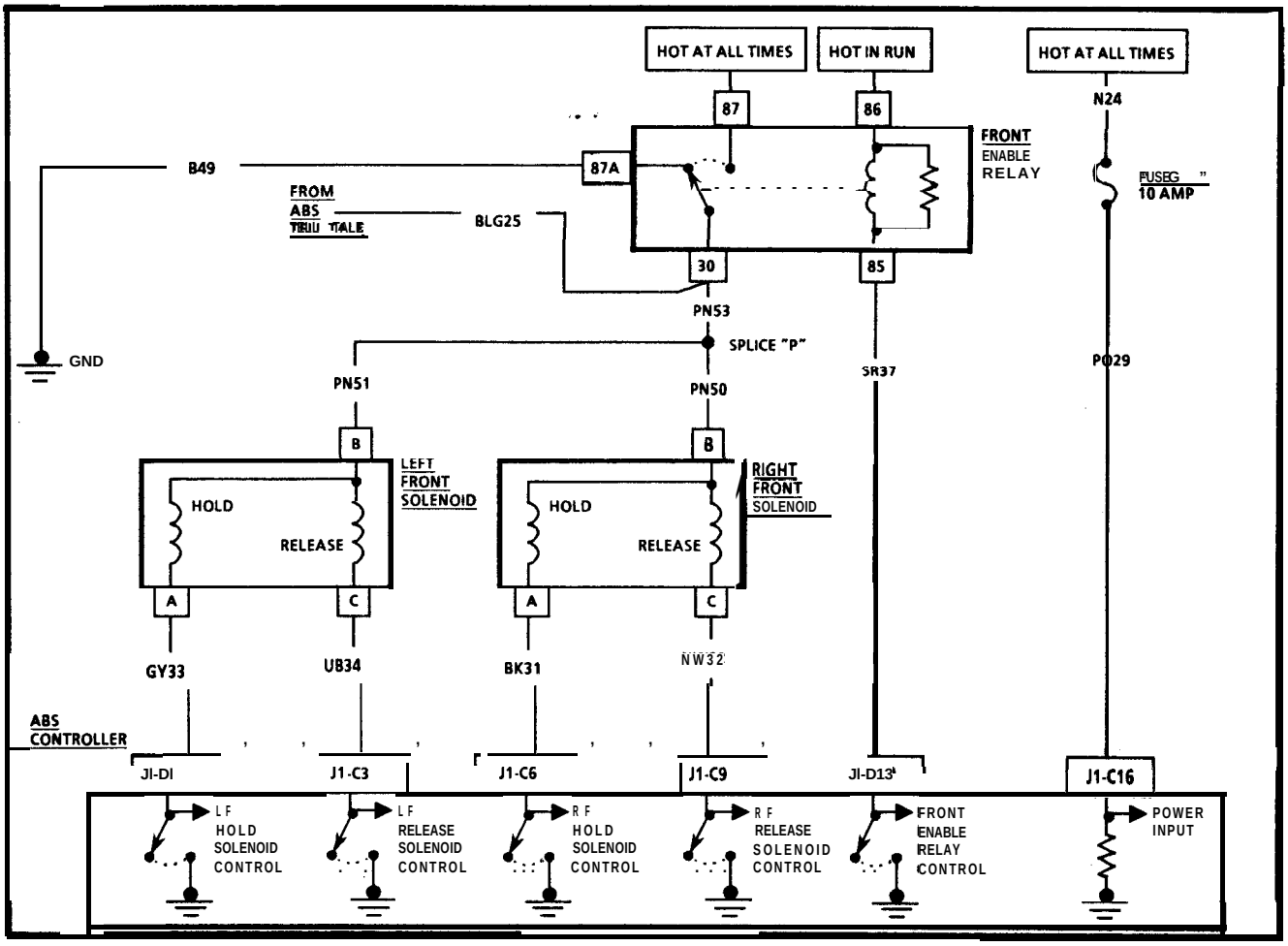
BRAKE PRESSURE OK

FAULT IS NOT PRESENT. SEE **NOTE ON** INTERMITTENTS IN INTRODUCTION.

BRAKE PRESSURE OK

CHECK FOR HYDRAULIC SYSTEM PROBLEM (REFER TO SECTION **"JF.13").** IF NO PROBLEM FOUND, REPLACE ACCUMULATOR SWITCH.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A037

FRONT ENABLE RELAY COIL SHORTED TO GROUND

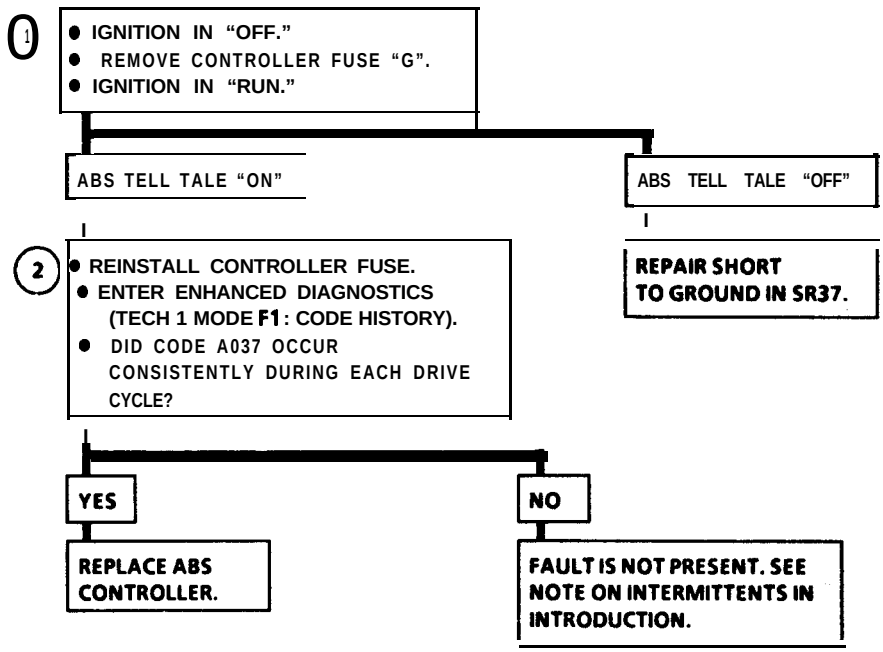
When the Front Enable Relay Control is open, the Front Enable Relay is deenergized. This prevents voltage from being applied to the Front Solenoids and Solenoid Controls. If the Front Enable Relay is deenergized and the Ignition is in "RUN," voltage should be present at Terminal "J1-D13".

CODE A037 will set during system initialization when all of the following conditions exist:

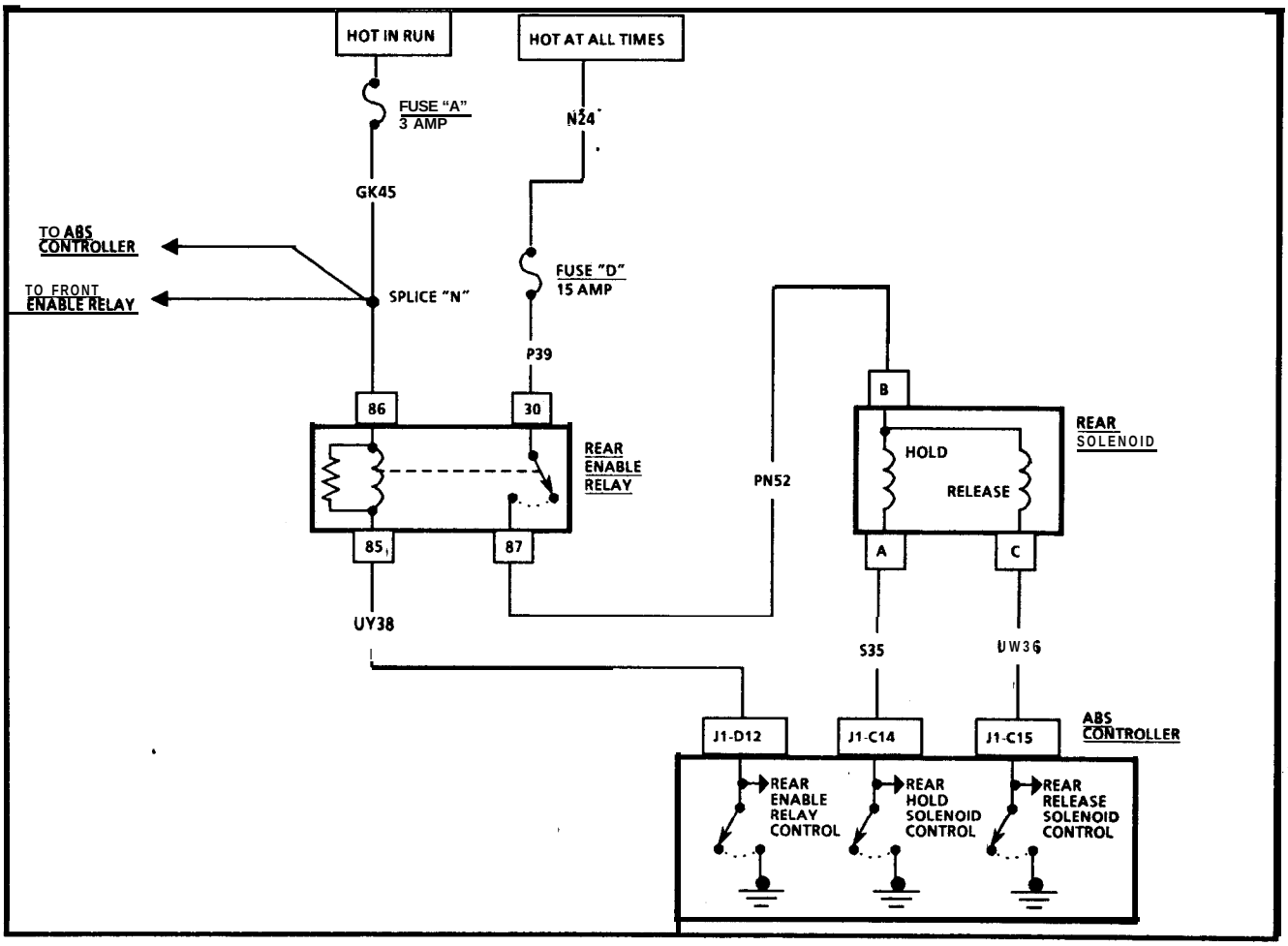
- The Front Enable Relay Control is open (Front Enable Relay deenergized).
- The ABS Controller senses no voltage at Terminal "Jl-D13".
- The ABS Controller senses Battery voltage at Terminals "Jl-Dl", "J1-C3", "J1-C6" and "J1-C9".

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. By isolating the Front Enable Relay Coil from its ground and observing the ABS Tell Tale, it can be determined whether the Front Enable Relay has deenergized (ABS Tell Tale lights) which indicates a possible defective ABS Controller or whether the Front Enable Relay has remained energized (ABS Tell Tale does not light) which indicates a short to ground in the SR37 wire.
2. If Code A037 is a consistent failure, the ABS Controller has an internal fault.


1
IGNITION IN "OFF."
REMOVE CONTROLLER FUSE "G".
IGNITION IN "RUN."
ABS TELL TALE "ON"
ABS TELL TALE "OFF"
REPAIR SHORT TO GROUND IN SR37.
2
REINSTALL CONTROLLER FUSE.
ENTER ENHANCED DIAGNOSTICS (TECH 1 MODE F1: CODE HISTORY).
DID CODE A037 OCCUR CONSISTENTLY DURING EACH DRIVE CYCLE?
YES
NO
REPLACE ABS CONTROLLER.
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A038

REAR ENABLE RELAY COIL SHORTED TO GROUND

When the Rear Enable Relay Control is open, the Rear Enable Relay is deenergized. This prevents voltage from being applied to the Rear Solenoid and Solenoid controls. If the Rear Enable Relay is deenergized and the Ignition is in "RUN," voltage should be present at terminal "Jl-D12".
CODE A038 will set during system initialization when all the following conditions exist:

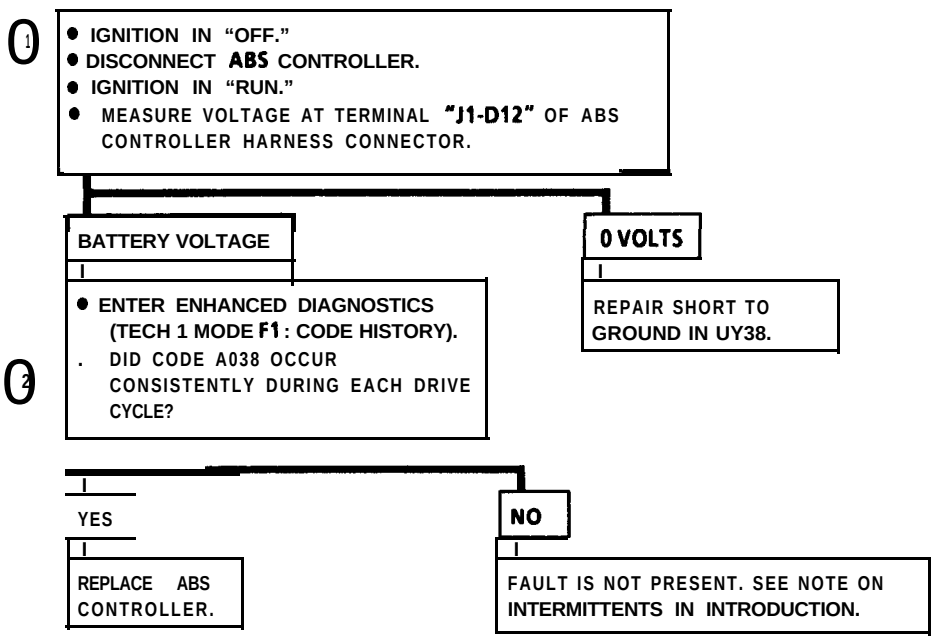
- The Rear Enable Relay control is open (Rear Enable Relay deenergized).
- The ABS Controller senses no voltage at Terminal "Jl-D12".
- ABS Controller senses Battery voltage at Terminal "Jl-C14" and "J1-C15".

Test Description: The following provides an explanation of the procedures being followed in the trouble tree.

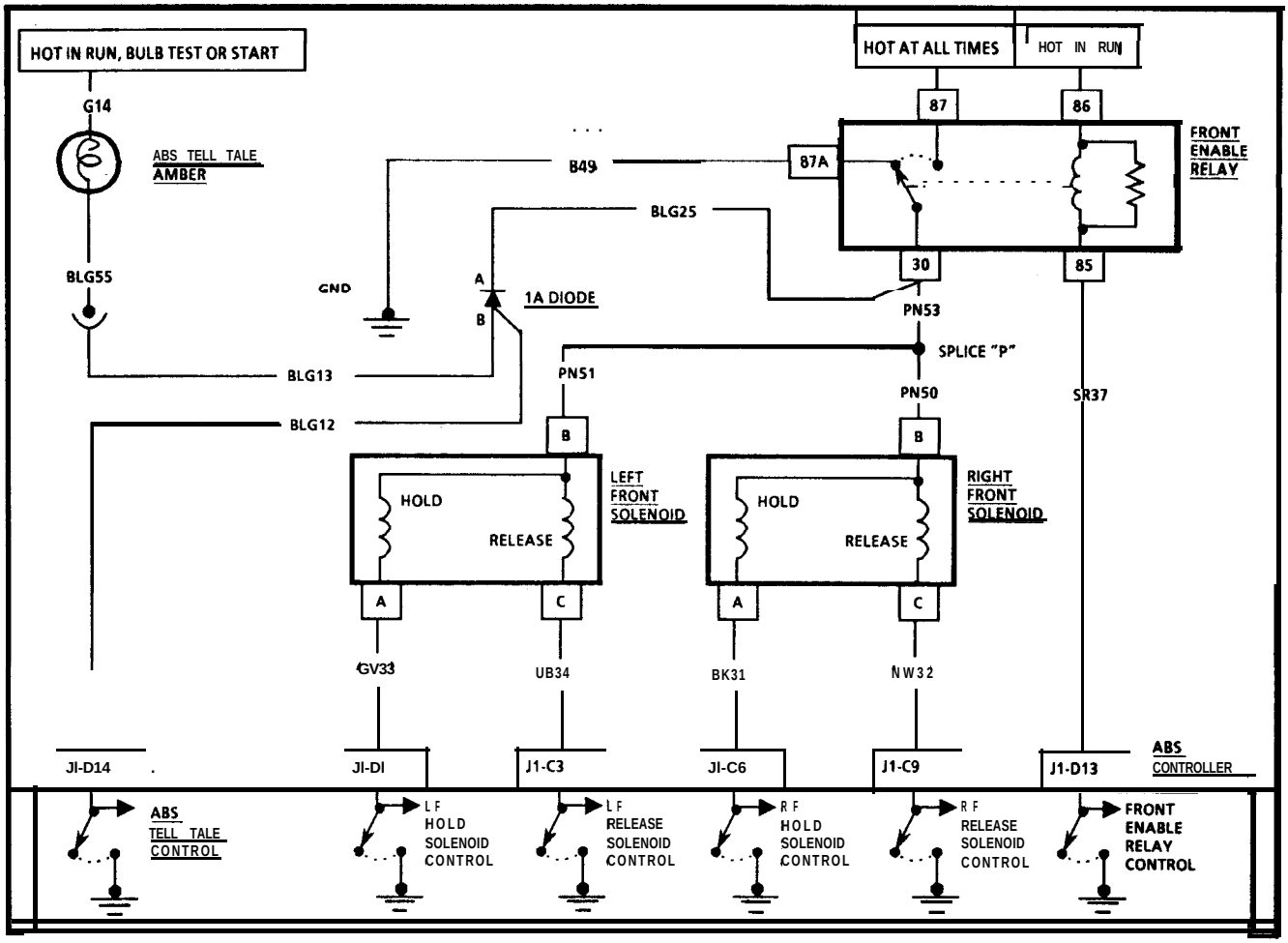
1. By isolating the Rear Enable Relay Control from its ground and measuring the voltage at Terminal "J1-D12" of the ABS Controller connector it can be determined whether the Rear Enable Relay has deenergized (Battery voltage at Terminal "Jl-D12") which indicates a possible defective ABS Controller or whether the Rear Enable Relay has remained energized (0 volts at Terminal "J1-D12") which indicates a short to ground in the UY38 circuit.
2. If Code A038 is a consistent failure, the ABS Controller has an internal fault.

CODE A038

REAR ENABLE RELAY COIL SHORTED TO GROUND


1
• IGNITION IN "OFF."
• DISCONNECT ABS CONTROLLER.
• IGNITION IN "RUN."
• MEASURE VOLTAGE AT TERMINAL "J1-D12" OF ABS CONTROLLER HARNESS CONNECTOR.
BATTERY VOLTAGE
0 VOLTS
REPAIR SHORT TO GROUND IN UY38.
2
• ENTER ENHANCED DIAGNOSTICS (TECH 1 MODE F1: CODE HISTORY).
. DID CODE A038 OCCUR CONSISTENTLY DURING EACH DRIVE CYCLE?
YES
NO
REPLACE ABS CONTROLLER.
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A039

FRONT ENABLE RELAY CONTACTS SHORTED TO BATTERY OR RELAY GROUND OPEN

When the Front Enable Relay Control is open, the Front Enable Relay is deenergized. This prevents voltage from being applied to the Front Solenoids and Solenoid Controls. If the B49 from the Front Enable Relay is open, Battery voltage from the ABS Tell Tale will be applied to the solenoids even when the Front Enable Relay is deenergized.

CODE A039 will set during system initialization when all of the following conditions exist:

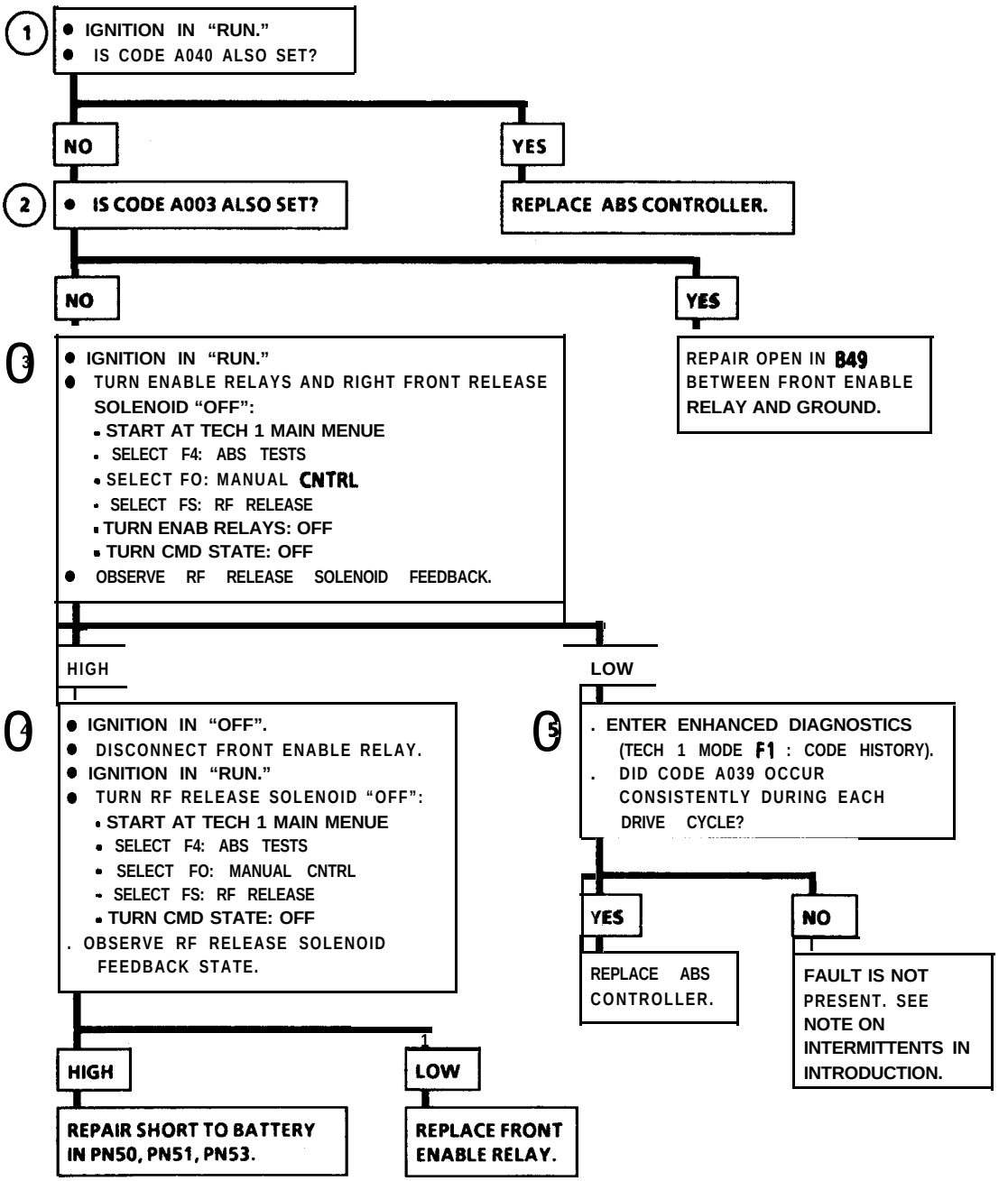
- The Front Enable Relay Control is open (Front Enable Relay deenergized).
- The ABS Controller senses Battery voltage at Terminals "Jl-Dl", "J1-C3", "J1-C6" and "J1-C9" (Front Solenoid controls).

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

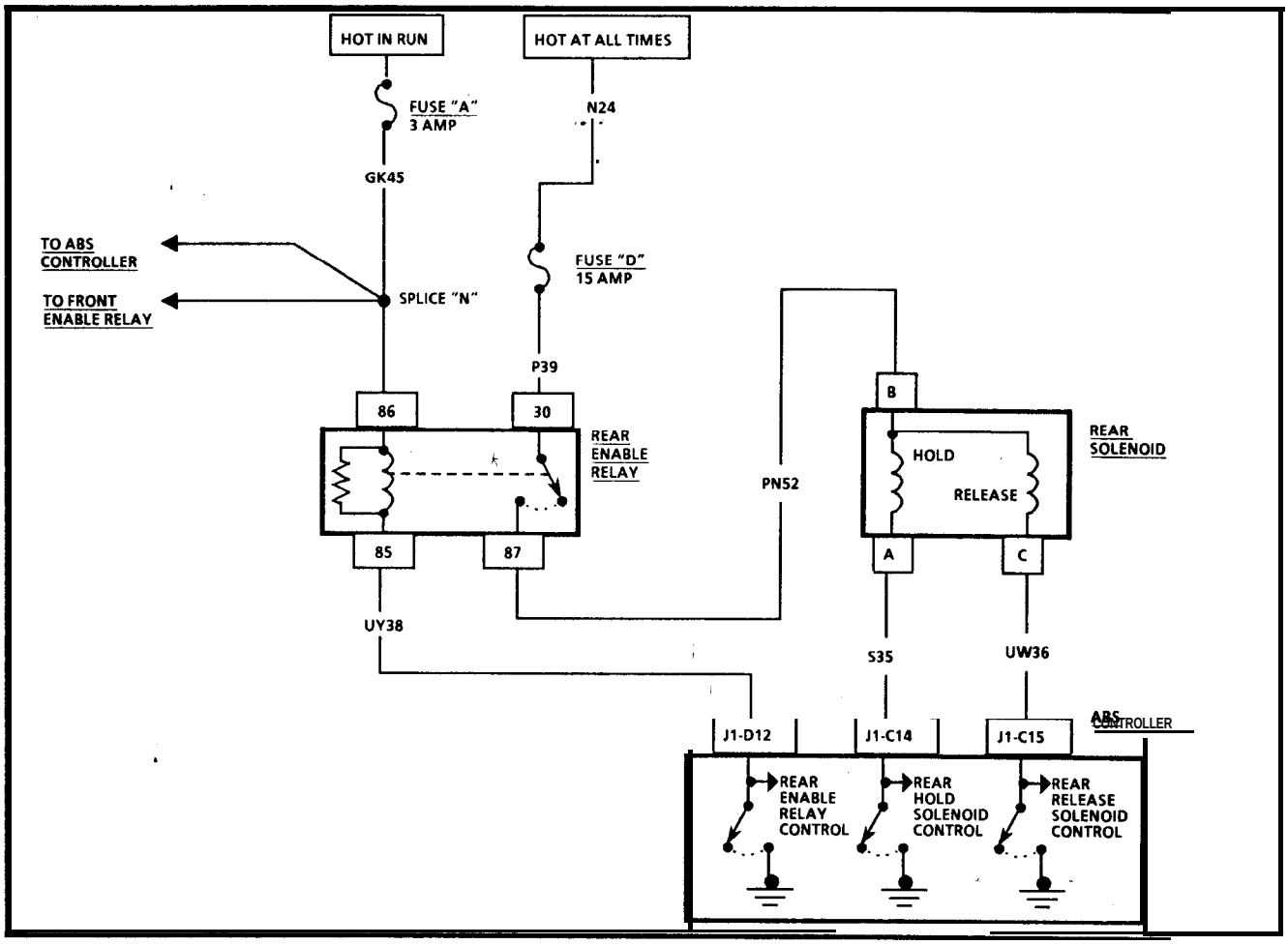
1. If Code A040 is also set, the ABS Controller has an internal failure.
2. If Code A003 is also set, the ground B49 must be open.
3. Determines if a short to Battery is present in the circuit or if the ABS Controller is possibly defective.
4. Isolates a short to Battery in PN50, PN51, PN53 or determines if the Front Enable relay is defective.
5. If Code A039 is a consistent failure, the ABS Controller has an internal fault.

CODE A039

FRONT ENABLE RELAY CONTACTS SHORTED TO BATTERY


1
• IGNITION IN "RUN."
• IS CODE A040 ALSO SET?
NO
YES
2
• IS CODE A003 ALSO SET?
REPLACE ABS CONTROLLER.
NO
YES
3
• IGNITION IN "RUN."
• TURN ENABLE RELAYS AND RIGHT FRONT RELEASE SOLENOID "OFF":
- START AT TECH 1 MAIN MENUE
- SELECT F4: ABS TESTS
- SELECT FO: MANUAL CNTRL
- SELECT FS: RF RELEASE
- TURN ENAB RELAYS: OFF
- TURN CMD STATE: OFF
• OBSERVE RF RELEASE SOLENOID FEEDBACK.
REPAIR OPEN IN B49 BETWEEN FRONT ENABLE RELAY AND GROUND.
HIGH
LOW
4
• IGNITION IN "OFF".
• DISCONNECT FRONT ENABLE RELAY.
• IGNITION IN "RUN."
• TURN RF RELEASE SOLENOID "OFF":
- START AT TECH 1 MAIN MENUE
- SELECT F4: ABS TESTS
- SELECT FO: MANUAL CNTRL
- SELECT FS: RF RELEASE
- TURN CMD STATE: OFF
. OBSERVE RF RELEASE SOLENOID FEEDBACK STATE.
5
. ENTER ENHANCED DIAGNOSTICS (TECH 1 MODE F1 : CODE HISTORY).
. DID CODE A039 OCCUR CONSISTENTLY DURING EACH DRIVE CYCLE?
HIGH
LOW
REPAIR SHORT TO BATTERY IN PN50, PN51, PN53.
REPLACE FRONT ENABLE RELAY.
YES
NO
REPLACE ABS CONTROLLER.
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A040

REAR ENABLE RELAY CONTACTS SHORTED TO BATTERY

When the Rear Enable Relay Control is open, the Rear Enable Relay is deenergized. This prevents voltage from being applied to the Rear Solenoid and Solenoid Controls.

CODE A040 will set during initialization when all the following conditions exist:

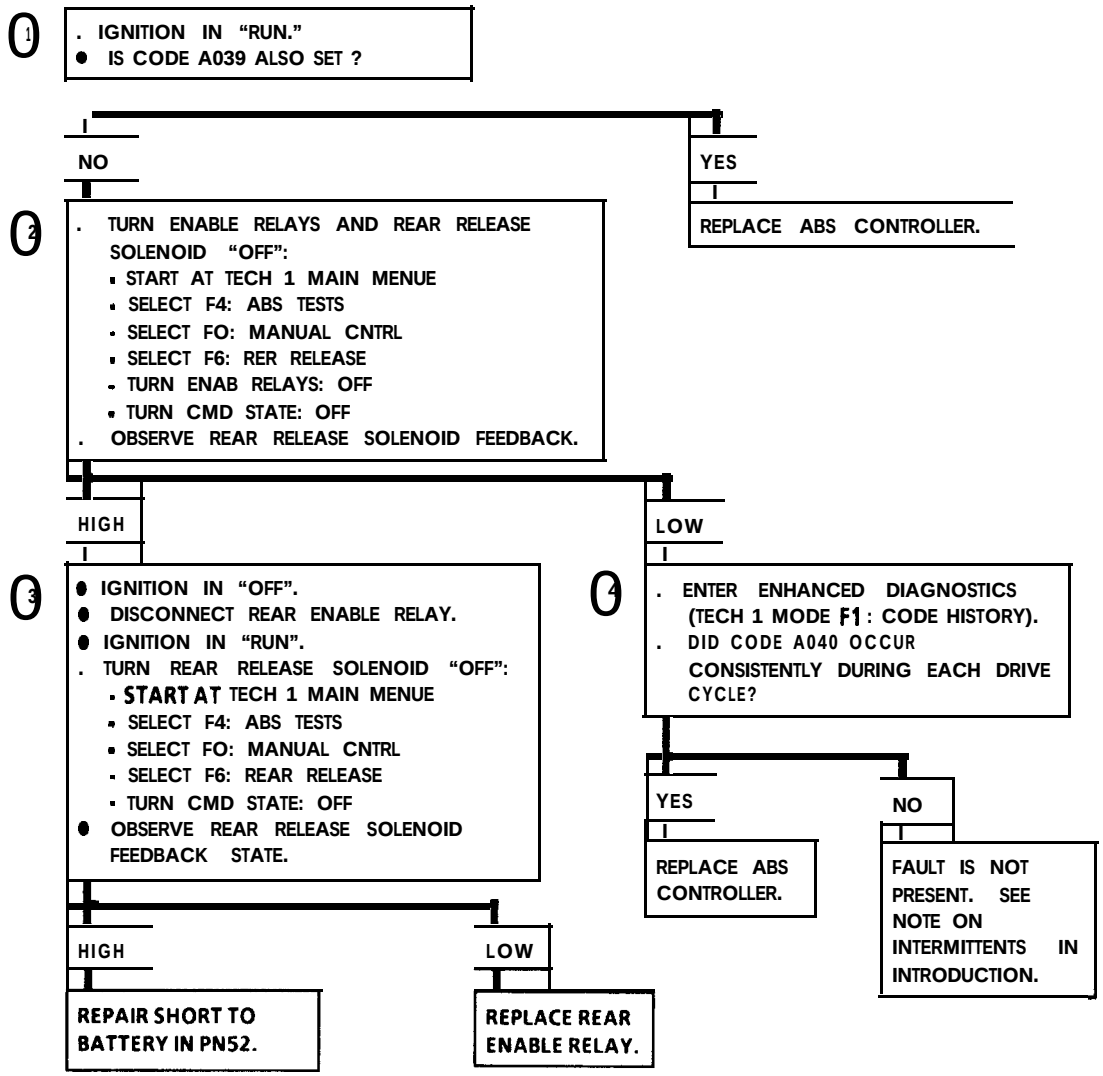
- The Rear Enable Relay Control is open (Rear Enable Relay deenergized).
- The ABS Controller senses Battery voltage at both terminals "J1-C14" and "Jl-C15".
- The ABS Controller senses Battery voltage at terminal "Jl-D12".

Test Description: The following provides an explanation of the procedures being followed in the trouble tree

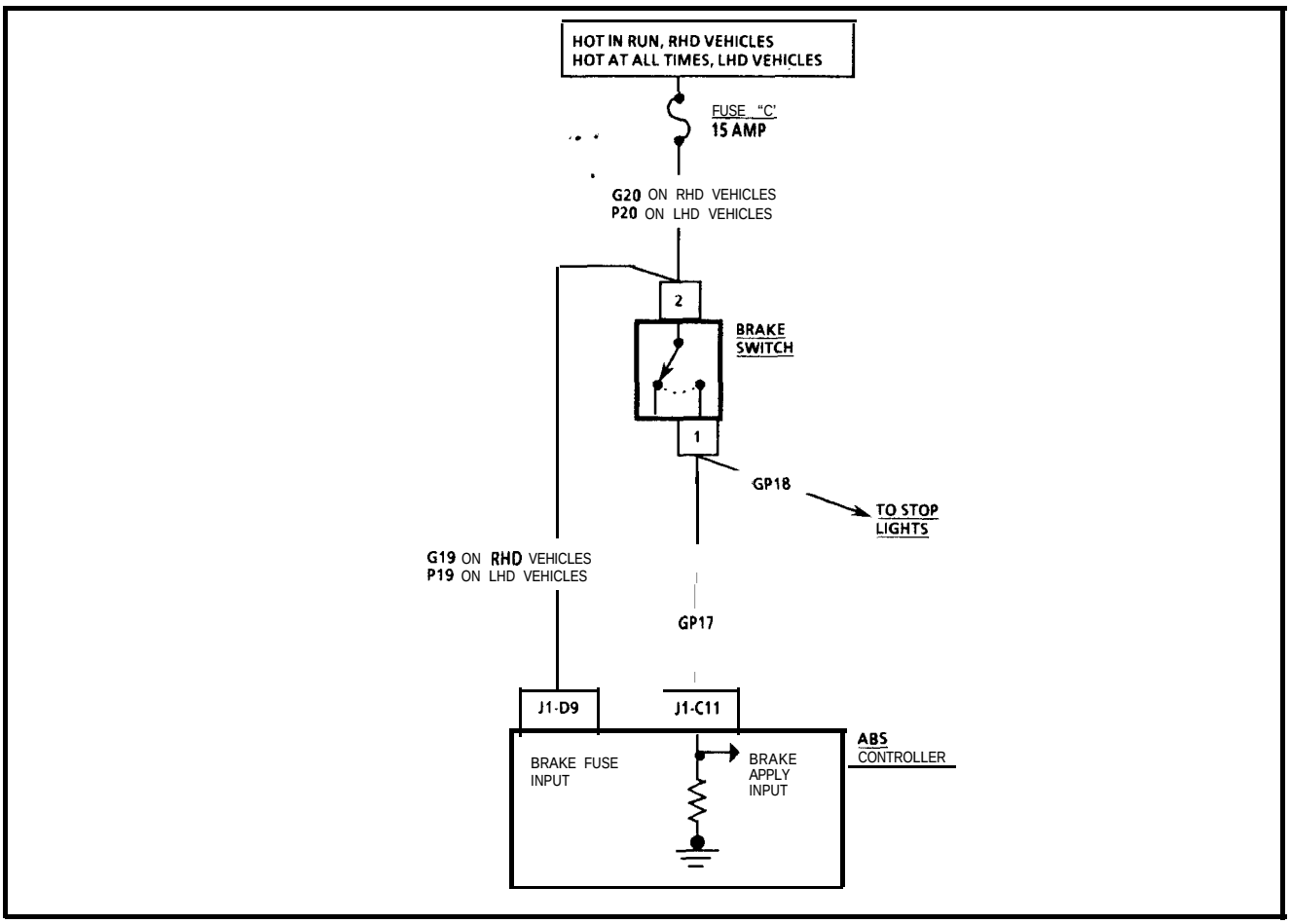
1. If Code A039 is also set, the ABS Controller has an internal failure.
2. Determines if a short to Battery is present in the circuit or if the ABS Controller is possibly defective.
3. Isolates a short to Battery in the PN52 or determines if the Rear Enable Relay is defective.
4. If Code A040 is a consistent failure, the ABS Controller has an internal fault.

CODE A040

REAR ENABLE RELAY CONTACTS SHORTED TO BATTERY


1
. IGNITION IN "RUN."
● IS CODE A039 ALSO SET ?
NO
YES
REPLACE ABS CONTROLLER.
2
. TURN ENABLE RELAYS AND REAR RELEASE SOLENOID "OFF":
▪ START AT TECH 1 MAIN MENUE
▪ SELECT F4: ABS TESTS
▪ SELECT FO: MANUAL CNTRL
▪ SELECT F6: RER RELEASE
▪ TURN ENAB RELAYS: OFF
▪ TURN CMD STATE: OFF
. OBSERVE REAR RELEASE SOLENOID FEEDBACK.
HIGH
LOW
3
● IGNITION IN "OFF".
● DISCONNECT REAR ENABLE RELAY.
● IGNITION IN "RUN".
. TURN REAR RELEASE SOLENOID "OFF":
▪ START AT TECH 1 MAIN MENUE
▪ SELECT F4: ABS TESTS
▪ SELECT FO: MANUAL CNTRL
▪ SELECT F6: REAR RELEASE
▪ TURN CMD STATE: OFF
● OBSERVE REAR RELEASE SOLENOID FEEDBACK STATE.
4
. ENTER ENHANCED DIAGNOSTICS (TECH 1 MODE F1: CODE HISTORY).
. DID CODE A040 OCCUR CONSISTENTLY DURING EACH DRIVE CYCLE?
YES
NO
REPLACE ABS CONTROLLER.
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
HIGH
LOW
REPAIR SHORT TO BATTERY IN PN52.
REPLACE REAR ENABLE RELAY.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A041

BRAKE SWITCH CIRCUIT OPEN

The ABS Controller determines that the Brake Pedal is pressed when battery voltage is sensed at the Brake Apply Input. If battery voltage is not present, the Controller should sense ground through "J1-C11, GP17" and the Stop Lights.

CODE A041 will set when all the following conditions exist:

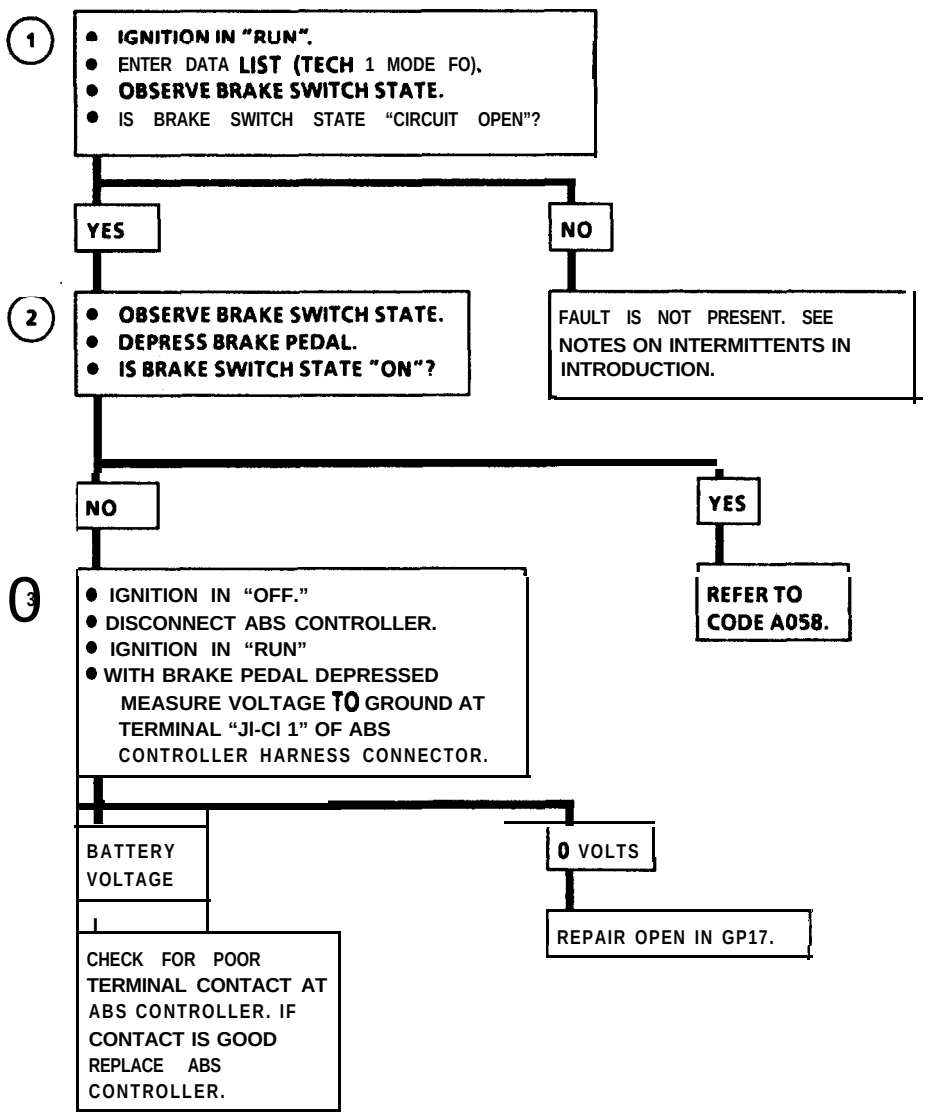
- Brake Switch is open (Battery voltage not sensed at Brake Apply Input).
- ABS Controller does not sense ground at Brake Apply Input (through "Jl-Cll, GP17, GP18" and brake light bulbs).

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

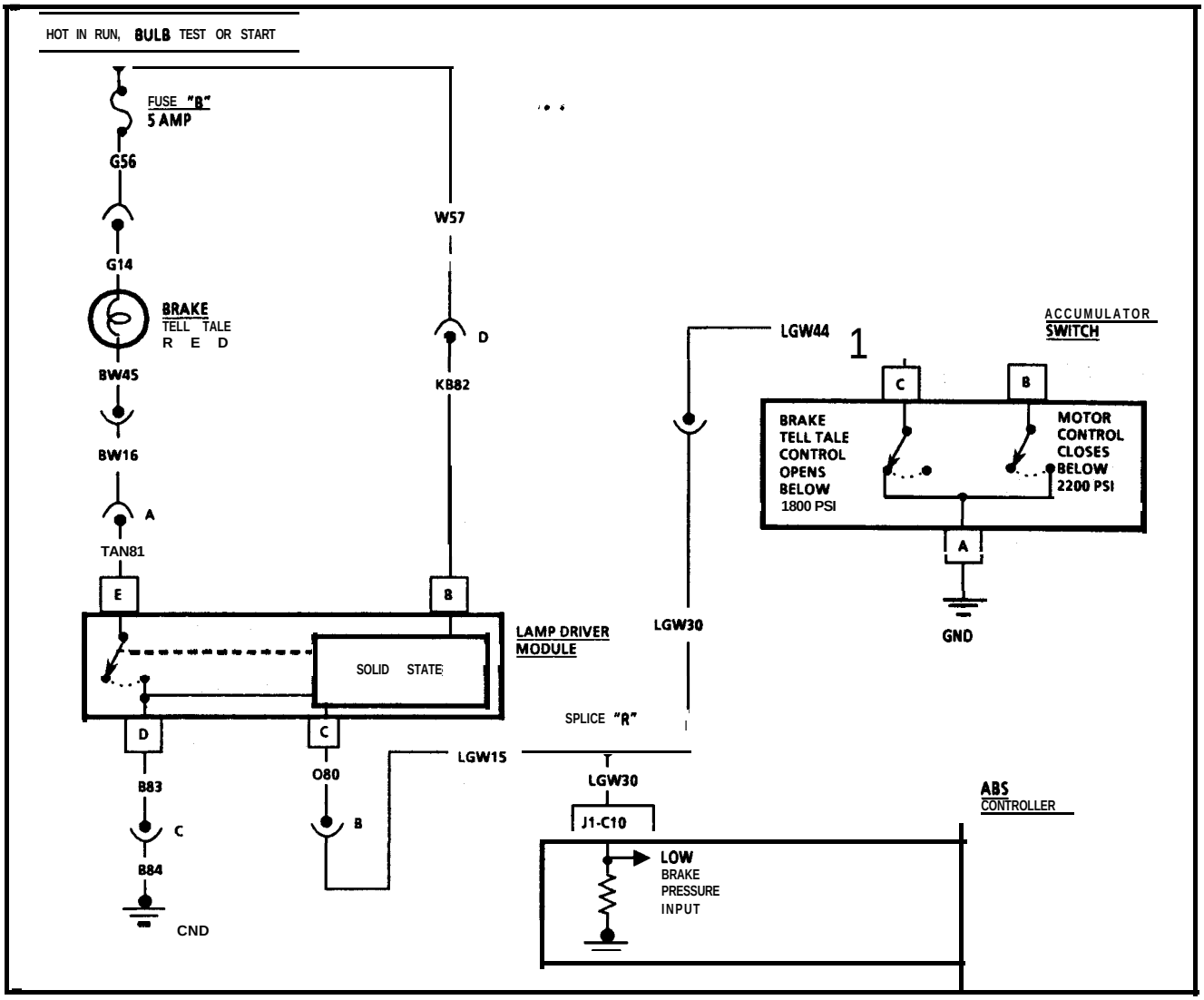
1. By observing the Brake Switch State it can be determined if the ABS Controller is sensing the proper input (a proper input at this point would indicate an intermittent fault condition).
2. Determines if the open condition exists in GP18 between the Brake Switch and the brake lights or if the open condition exists in GP17 between the Brake Switch and the ABS Controller "J1-C11".
3. Isolates the open condition to "GP17" between the Brake Switch and the ABS Controller if 0 volts was measured at Terminal "Jl-Cll" of ABS Controller. If Battery voltage was measured at Terminal "Jl-Cll" it indicates that the ABS Controller is defective.

CODE A041

BRAKE SWITCH CIRCUIT OPEN


1
• IGNITION IN "RUN".
• ENTER DATA LIST (TECH 1 MODE FO).
• OBSERVE BRAKE SWITCH STATE.
• IS BRAKE SWITCH STATE "CIRCUIT OPEN"?
YES
NO
2
• OBSERVE BRAKE SWITCH STATE.
• DEPRESS BRAKE PEDAL.
• IS BRAKE SWITCH STATE "ON"?
FAULT IS NOT PRESENT. SEE NOTES ON INTERMITTENTS IN INTRODUCTION.
NO
YES
REFER TO CODE A058.
0 3
• IGNITION IN "OFF."
• DISCONNECT ABS CONTROLLER.
• IGNITION IN "RUN"
• WITH BRAKE PEDAL DEPRESSED MEASURE VOLTAGE TO GROUND AT TERMINAL "JI-CI 1" OF ABS CONTROLLER HARNESS CONNECTOR.
BATTERY VOLTAGE
0 VOLTS
CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER. IF CONTACT IS GOOD REPLACE ABS CONTROLLER.
REPAIR OPEN IN GP17.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A042

LOW BRAKE PRESSURE CIRCUIT OPEN

When the Low Pressure Switch in the Accumulator Switch is closed (pressure greater than approximately 1800 PSI), the ABS Controller senses ground at the Low Brake Pressure Input. If the Low Pressure Switch is open (pressure less than 1800 PSI) the Lamp Driver Module loses ground at terminal C. The Lamp Driver Module turns on the Brake Tell Tale and applies voltage to the Low Brake Pressure Input. If the ABS Controller does not sense ground or battery voltage at the Low Brake Pressure Input, it will set Code A042.

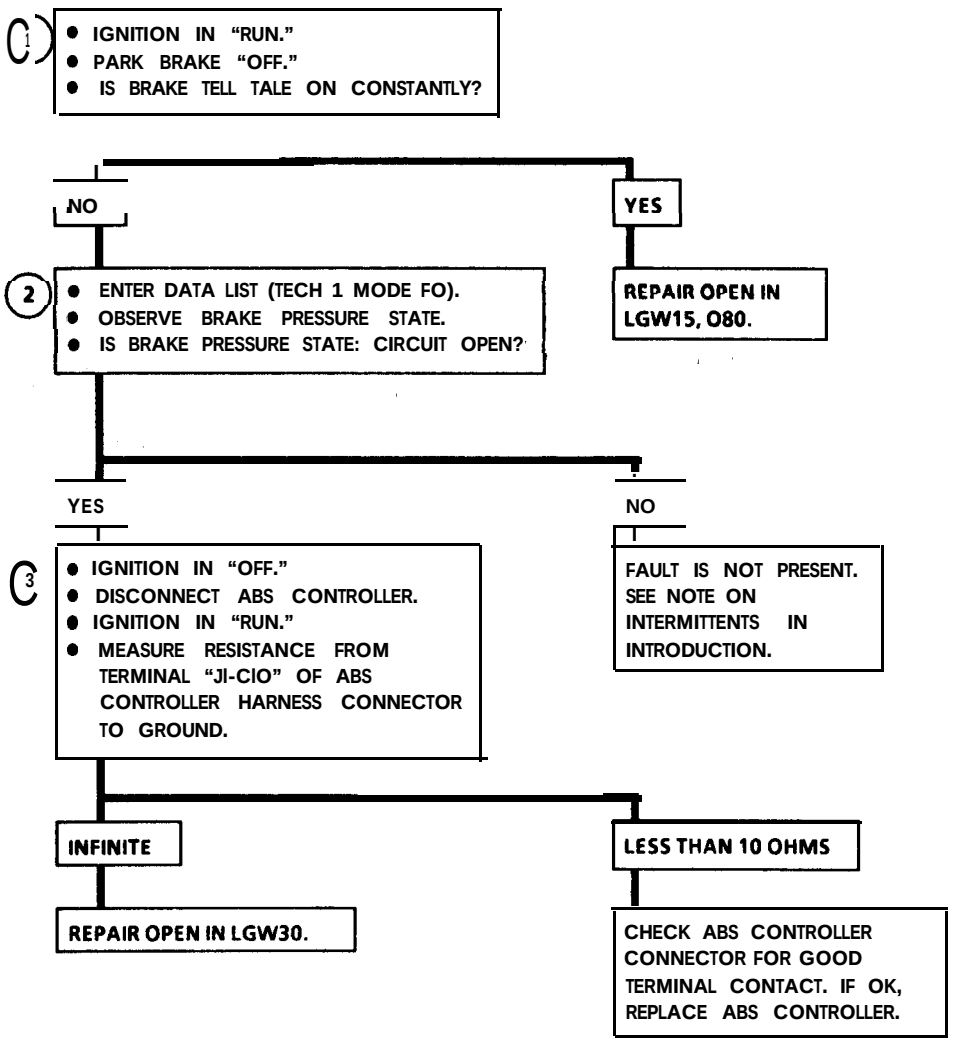
CODE A042 will set when the ABS Controller senses that an open condition exists in the LGW15, 080, LGW30 between the Controller and the Lamp Driver Module.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

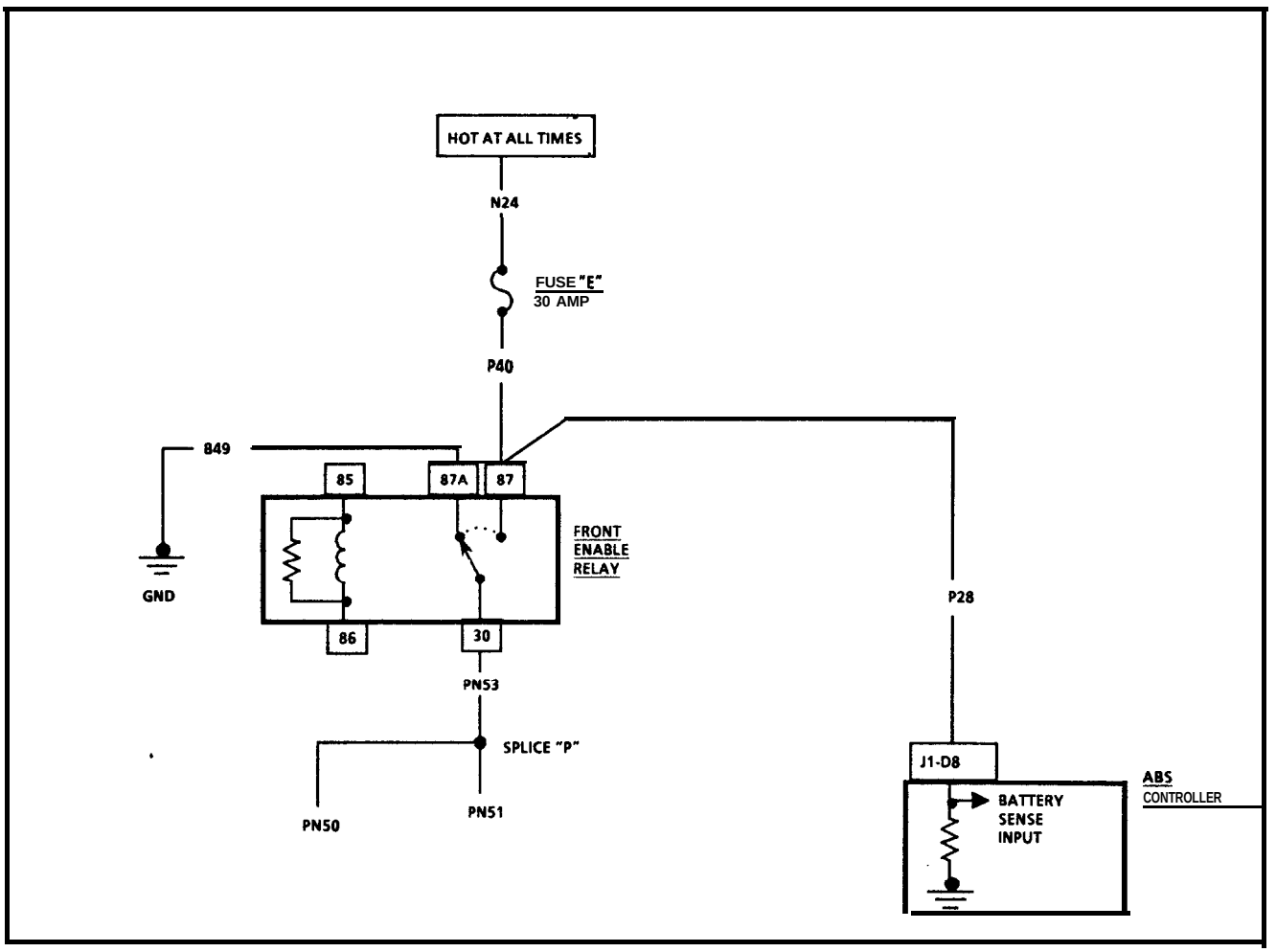
1. If the Brake Tell Tale lights constantly, there must be an open in the LGW15, 080 between the Lamp Driver Module and Splice "R".
2. Determines if open condition is currently present.
3. Isolates the open condition to LGW30 between Splice "R" and the ABS Controller or determines a defective ABS Controller.

CODE A042

LOW BRAKE PRESSURE CIRCUIT OPEN


1
• IGNITION IN "RUN."
• PARK BRAKE "OFF."
• IS BRAKE TELL TALE ON CONSTANTLY?
NO
YES
2
• ENTER DATA LIST (TECH 1 MODE FO).
• OBSERVE BRAKE PRESSURE STATE.
• IS BRAKE PRESSURE STATE: CIRCUIT OPEN?
REPAIR OPEN IN LGW15, O80.
YES
NO
3
• IGNITION IN "OFF."
• DISCONNECT ABS CONTROLLER.
• IGNITION IN "RUN."
• MEASURE RESISTANCE FROM TERMINAL "JI-CIO" OF ABS CONTROLLER HARNESS CONNECTOR TO GROUND.
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
INFINITE
LESS THAN 10 OHMS
REPAIR OPEN IN LGW30.
CHECK ABS CONTROLLER CONNECTOR FOR GOOD TERMINAL CONTACT. IF OK, REPLACE ABS CONTROLLER.

AN EXPLANATION OF EACH TEST PROCEDURE REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A043

SYSTEM VOLTAGE IS LOW

Voltage from Fuse "E" is applied at ail times to the Front Enable Relay Terminal "87" and the ABS Controller Battery Sense input "J1-D8". Since the ABS Controller needs greater than 9.7 volts to properly operate, Code A043 is set when the applied voltage is less than 9.7volts
CODE A043 will set when the voltage being supplied to Terminal "J1-D8" of the ABS Controller is below 9.7 volts and vehicle speed has exceeded 10 mph.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. Determines if the Battery or charging system is faulty, or isolates the problem to the Antilock Brake system.
2. If Code A005 is not set, the problem is in the P28.
3. Checks for short to ground in P40, P28.
4. Checks for short to ground in PN50, PN51. PN53.
5. Determines if open is present before or after Fuse "E".
6. Indicates if open is in P28 or possibly internal to Controller.
7. Determines if fault is a constant failure internal to ABS Controller or an intermittent.

CODE A043
SYSTEM VOLTAGE IS LOW

1. ● IGNITION IN "RUN."
● MEASURE VOLTAGE ACROSS BATTERY TERMINALS.

ABOVE 9.7 VO LTS

2. ● IS CODE AOOS ALSO SET?

BELOW 9.7 VOLTS

CHECK FOR PROPER GENERATOR OUTPUT AND TEST BATTERY AS NECESSARY.

YES

● CHECK FUSE "E".

FUSE BLOWN

3. ● IGNITION IN "OFF."
● DISCONNECT ABS
. CONTROLLER.
● REMOVE BLOWN FUSE "E".
. CONNECT TEST LAMP ACROSS FUSE "E" SOCKET TERMINALS.

TEST LAMP DOES NOT LIGHT

4. ● IGNITION IN "OFF"
● DISCONNECT FRONT ENABLE RELAY
. MEASURE RESISTANCE BEMEEN TERMINAL "30" OF FRONT ENABLE RELAY HARNESS CONNECTOR AND GROUND.

INFINITE

REPLACE FUSE 'E", SYSTEM IS OK.

10 OHMS OR LESS

CHECK TERMINAL "30" OF FRONT ENABLE RELAY HARNESS CONNECTOR AND **PN50, PN51,** PN53 FOR SHORT TO GROUND.

TEST LAMP LIGHTS

REPAIR SHORT TO GROUND IN **P40** OR **P28.**

FUSE NOT BLOWN

5. ● IGNITION IN "OFF."
● DISCONNECT FRONT ENABLE RELAY.
● REMOVE FUSE "E".
● IGNITION IN "RUN".
● MEASURE VOLTAGE TO GROUND AT N24 SIDE OF FUSE "E" SOCKET.

0 VOLTS

REPAIR OPEN IN N24.

BATTERY VOLTAGE

REPAIR OPEN IN **P40.**

NO

6. ● IGNITION "OFF."
. DISCONNECT ABS CONTROLLER.
. IGNITION IN "RUN."
● MEASURE VOLTAGE FROM ABS CONTROLLER HARNESS CONNECTOR TERMINAL 'JI-DB" TO GROUND.

BATTERY VOLTAGE

7. ● IGNITION IN "OFF".
● RECONNECT ABS CONTROLLER.
● IGNITION IN "RUN."
● ENTER DATA LIST (TECH 1 MODE FO).
. READ BATTERY VOLTAGE STATE.

0 VOLTS

REPAIR OPEN IN **P28.**

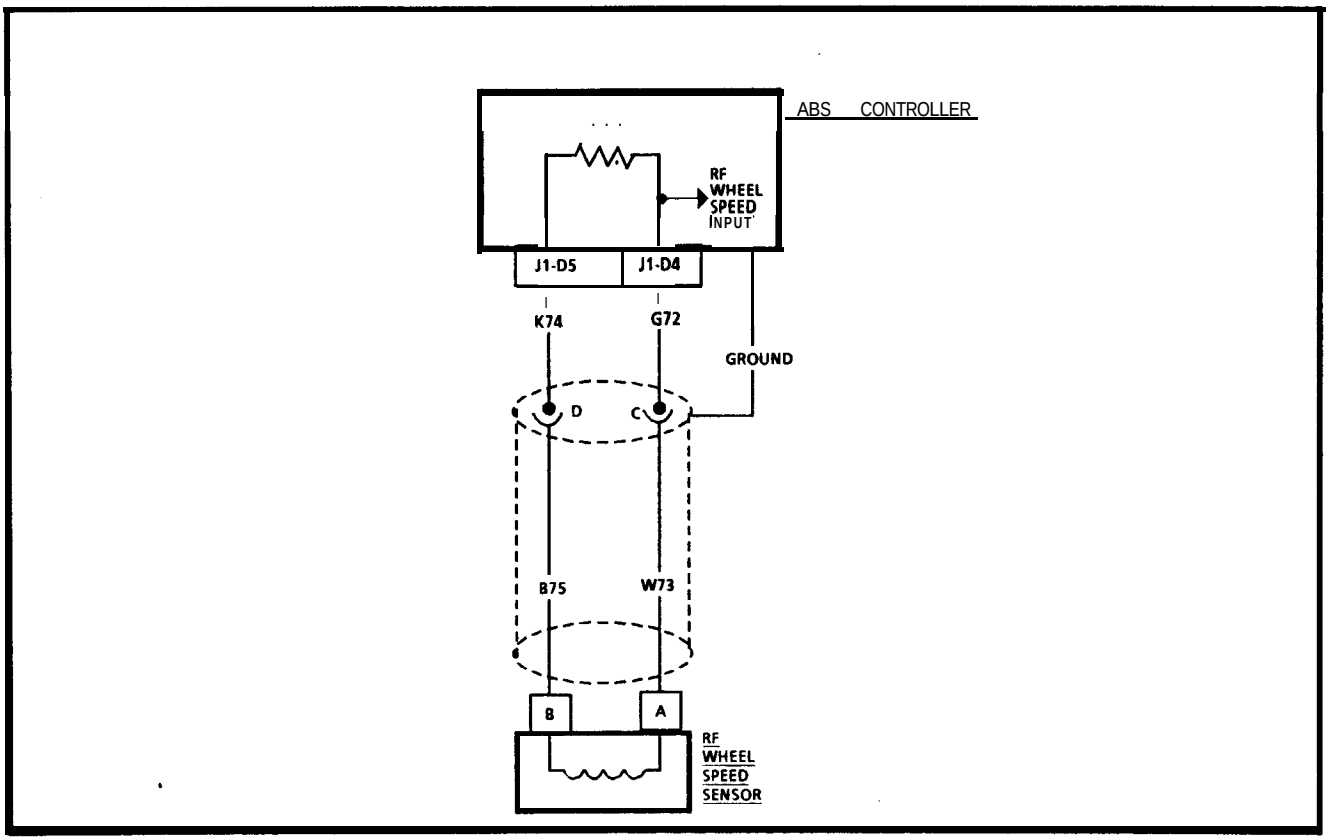
OK

FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

LOW

CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER. IF CONTACT IS GOOD, REPLACE **ABS CONTROLLER.**

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A044

RIGHT FRONT WHEEL SPEED = 0

The Wheel Speed Sensor generates a signal that indicates the speed of the wheel. Voltage pulses are produced as the magnetic teeth pass a coil. The frequency of this AC voltage is used by the Controller to determine how fast the wheel is turning. By comparing this wheel speed to the other wheel speeds, the Controller can detect if wheel lock-up is about to occur.

CODE A044 will set when all of the following conditions exist:

- The ABS Controller senses the right front wheel speed to be 0 mph.
- The ABS Brake Controller senses that the other three wheel speeds are greater than 5 mph and are operating correctly.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. Observation of erratic or no wheel speed input indicates the fault is present and is not intermittent.

2.& 3. Step 2 determines if a short to battery is the fault. If battery voltage is measured, Step 3 isolates the short to the harness or controller.

4. If 9000 to 11000 ohms is measured, the possibility of an open or short in the circuit between the ABS Controller and the male half of Wheel Speed Sensor Harness Connector is eliminated.

CODE A044

RIGHT FRONT WHEEL SPEED = 0

(1)
- IGNITION IN "RUN."
- ENTER DATA LIST (TECH 1 MODE FO).
- MONITOR RIGHT FRONT WHEEL SPEED WHILE GRADUALLY DECELERATING FROM 25 MPH TO 0 MPH.

ERRATIC OR NO WHEEL SPEED OBSERVED

STEADY WHEEL SPEED OBSERVED THAT DECREASES AT A STEADY RATE AS THE WHEEL SLOWS TO A STOP.

FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

(2)
- IGNITION IN "OFF".
- DISCONNECT THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT.
- IGNITION IN "RUN".
- CHECK FOR VOLTAGE BETWEEN TERMINAL "D" ON THE MALE HALF OF THE WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND, AND THEN CHECK FOR VOLTAGE BETWEEN TERMINAL "C" AND GROUND.
- IS BATTERY VOLTAGE MEASURED AT EITHER TERMINAL "C" OR "D"? NOTE: NORMAL INDICATION IS APPROX. 2.5 VOLT DC.

NO

YES

(3)
- IGNITION "OFF."
- MEASURE RESISTANCE ACROSS TERMINALS "C" AND "D" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.

(3)
- IGNITION "OFF."
- DISCONNET ABS CONTRROLLER.
- IGNITION IN "RUN."
- REPEAT MEASUREMENT OF STEP (2).
- IS BATTERY VOLTAGE MEASURED AT EITHER TERMINAL "C" OR "D"?

0 OHMS

BETWEEN 9000 AND 11000 OHMS

INFINITE

YES

NO

- DISCONNECT ABS CONTROLLER.
- MEASURE RESISTANCE ACROSS TERMINALS "C" AND "D" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.

A

CONTINUED ON PAGE 107

B

CONTINUED ON PAGE 109

REPAIR SHORT TO BATTERY IN K74 OR 672.

REPLACE ABS CONTROLLER.

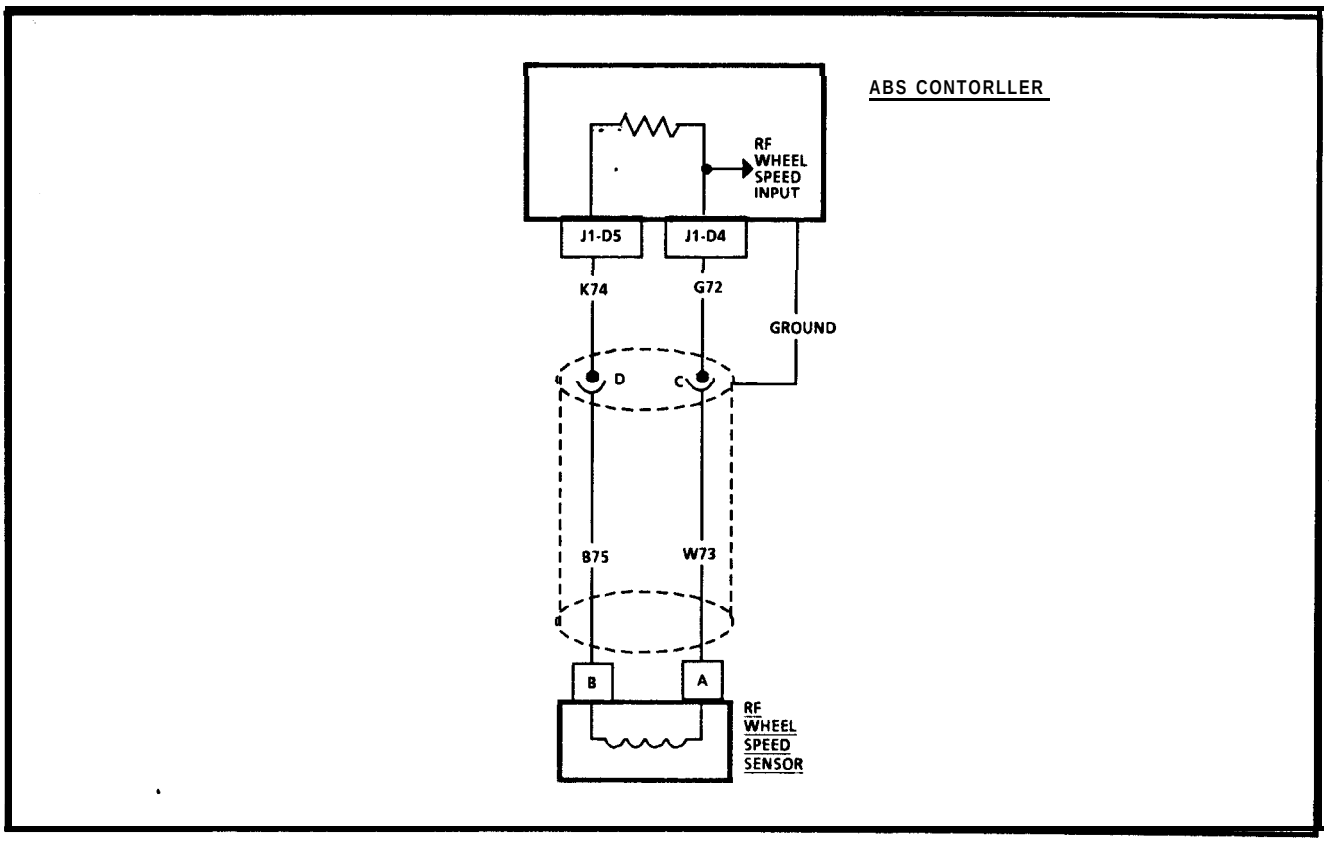
0 OHMS

INFINITE

REPAIR SHORT BETWEEN K74 AND G72.

CHECK FOR CLEAN TERMINAL CONTACT AT ABS CONTROLLER. REPLACE CONTROLLER IF TERMINAL IS GOOD.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A044

RIGHT FRONT WHEEL SPEED = 0

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

5. If more than 10 ohms is measured the circuits between the ABS Controller and the male half of the Wheel Speed Sensor Harness Connector are OK. This isolates the fault to be between the Wheel Speed Sensor and the female half of the Wheel Speed Sensor Harness Connector. Since this area of circuit is exposed to the elements and road debris, it should be carefully inspected for damage.
6. This procedure isolates the fault to a short to ground (998 to 1208 ohms) or open (above 1208 ohms) or a shorted sensor circuit (below 998 ohms).

7. & 8. Determines if the fault is in the harness or the Wheel Speed Sensor. If the harness between the Wheel Speed Sensor Harness Connector in the front luggage compartment and the Wheel Speed Sensor is defective, replace it. Do not attempt to repair it.

CODE A044

RIGHT FRONT WHEEL SPEED = 0

CONTINUED FROM PAGE 105

A

05 • MEASURE RESISTANCE BETWEEN TERMINAL "D" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND, AND THEN MEASURE RESISTANCE BETWEEN TERMINAL "C" AND GROUND.
. WAS EITHER MEASURMENT LESS THAN 10 OHMS ?

NO

06 • MEASURE RESISTANCE ACROSS TERMINALS "C" AND "D" ON FEMALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.

ABOVE 1208 OHMS OR BELOW 998 OHMS

08 • DISCONNECT RF WHEEL SPEED SENSOR.
• MEASURE RESISTANCE ACROSS WHEEL SPEED SENSOR.

ABOVE 1208 OHMS OR BELOW 998 OHMS

CLEAN WHEEL SPEED SENSOR TERMINALS OF ANY MOISTURE, CORROSION, DIRT, ETC. RECHECK RESISTANCE ACROSS WHEEL SPEED SENSOR. IF RESISTANCE STILL MEASURES ABOVE 1208 OHMS OR BELOW 998 OHMS, REPLACE RF WHEEL SPEED SENSOR.

BETWEEN 998 AND 1208 OHMS

07 . DISCONNECT RF WHEEL SPEED SENSOR.
. MEASURE RESISTANCE BETWEEN TERMINAL "A" AT WHEEL SPEED SENSOR AND GROUND.

INFINITE

REPLACE HARNESS BETWEEN WHEEL SPEED SENSOR HARNESS CONNECTOR AND SPEED SENSOR.

1 MEGOHM OR LESS

REPLACE RF WHEEL SPEED SENSOR.

BETWEEN 998 AND 1208 OHMS

REPLACE HARNESS BETWEEN WHEEL SPEED SENSOR HARNESS CONNECTOR AND SPEED SENSOR.

YES

. DISCONNECT ABS CONTROLLER.
• REPEAT MEASUREMENT OF STEP ⑤.
. WAS EITHER MEASUREMENT LESS THAN 10 OHMS ?

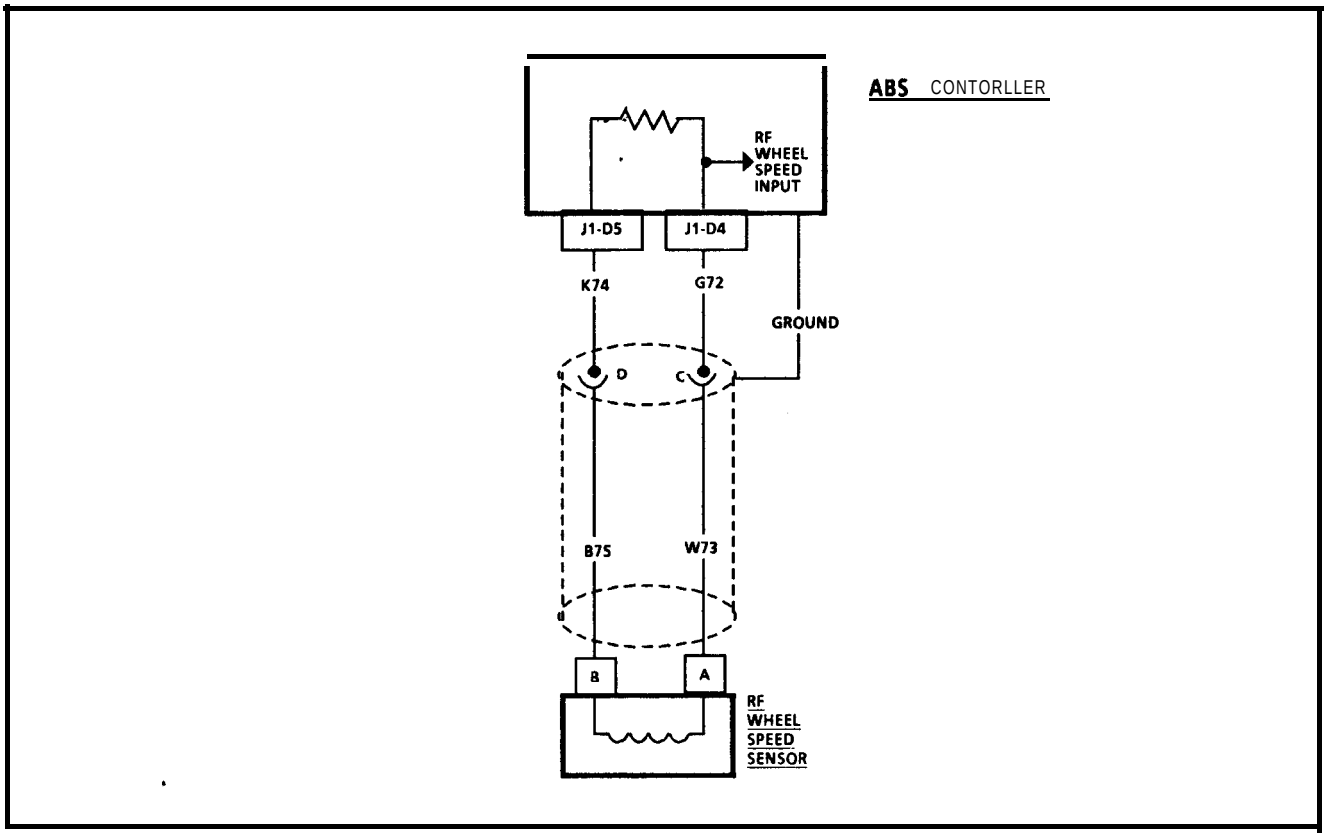
YES

REPAIR SHORT TO GROUND IN K74 OR 672.

NO

REPLACE ABS CONTROLLER.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A044

RIGHT FRONT WHEEL SPEED = 0

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

10. With male of G72 connected to ground, the resistance from Terminal "J1-D4" to ground should be zero. If infinite resistance is measured, an open condition is indicated in G72.
11. With male of K74 connected to ground, the resistance from Terminal "Jl-D5" to ground should be zero. If infinite resistance is measured, an open condition is indicated in K74.

CODE A044

RIGHT FRONT WHEEL SPEED = 0

CONTINUED FROM PAGE 105

B

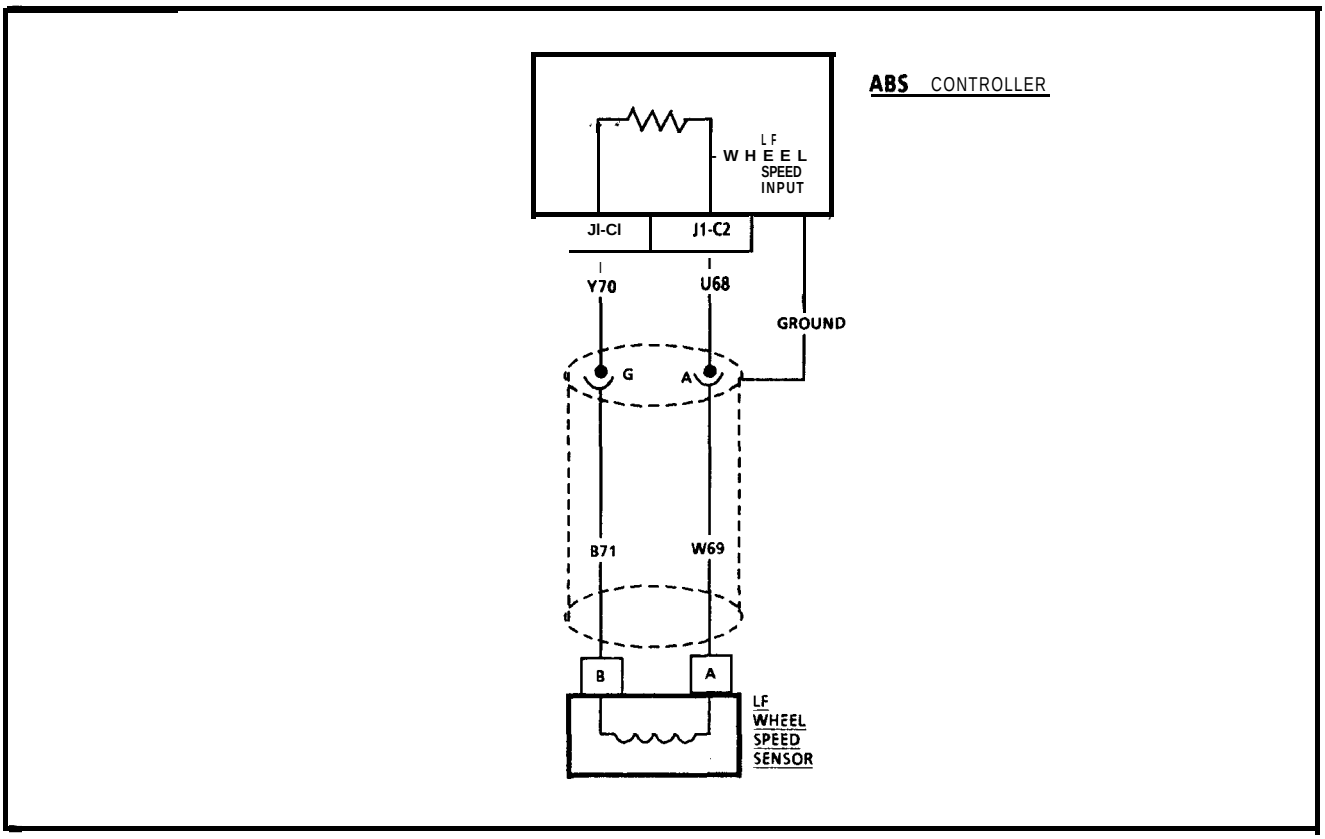
10 . CONNECT JUMPER BETWEEN TERMINAL "C" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND.
. DISCONNECT ABS CONTROLLER.
. MEASURE RESISTANCE BETWEEN TERMINAL "J1-D4" OF ABS CONTROLLER HARNESS CONNECTOR AND GROUND.

- 0 OHMS
- INFINITE → REPAIR OPEN IN G72.

11 . CONNECT JUMPER BETWEEN TERMINAL "D" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND.
. MEASURE RESISTANCE BETWEEN TERMINAL "J1-D5" OF ABS CONTROLLER HARNESS CONNECTOR AND GROUND.

- 0 OHMS → CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER, REPLACE ABS CONTROLLER IF CONTACT IS GOOD.
- INFINITE → REPAIR OPEN IN K74.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A045

LEFT FRONT WHEEL SPEED = 0

The Wheel Speed Sensor generates a signal that indicates the speed of the wheel. Voltage pulses are produced as the magnetic teeth pass a coil. The frequency of this AC voltage is used by the ABS Controller to determine how fast the wheel is turning. By comparing this wheel speed to the other wheel speeds, the ABS Controller can detect if wheel lock-up is about to occur.

CODE A045 will set when all of the following conditions exist:

- The ABS Controller senses the left front wheel speed to be 0 mph.
- The ABS Brake Controller senses that the other three wheel speeds are greater than 5 mph and are operating correctly.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. Observation of erratic or no wheel speed input indicates the fault is present and is not intermittent.

2.& 3. Step 2 determines if a short to battery is the fault. If battery voltage is measured, Step 3 isolates the short to the harness or controller.

4. If 9000 to 11000 ohms is measured! the possibility of an open or short in the circuit between the ABS Controller and the male half of Wheel Speed Sensor Harness Connector is eliminated.

CODE A045

LEFT FRONT WHEEL SPEED = 0

(1)
- IGNITION IN "RUN".
- ENTER DATA LIST (TECH 1 MODE F0).
- MONITOR LEFT FRONT WHEEL SPEED WHILE GRADUALLY DECELERATING FROM 25 MPH TO 0 MPH.

ERRATIC OR NO WHEEL SPEED OBSERVED

STEADY WHEEL SPEED OBSERVED THAT DECREASES AT A STEADY RATE AS THE WHEEL SLOWS TO A STOP.

FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

(2)
- IGNITION IN "OFF".
- DISCONNECTTHE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT.
- IGNITION IN "RUN".
- CHECK FOR VOLTAGE BETWEEN TERMINAL "A" ON THE MALE HALF OF THE WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND, AND THEN CHECK FOR VOLTAGE BETWEEN TERMINAL "G" AND GROUND.
- IS BATTERY VOLTAGE MEASURED AT EITHER TERMINAL "A" OR "G"?

NOTE: NORMAL INDICATION IS APPROX. 2.5 VOLT DC.

NO

YES

(4)
- IGNITION "OFF."
- MEASURE RESISTANCE ACROSS TERMINALS "A" AND "G" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.

(3)
- IGNITION "OFF."
- DISCONNET ABS CONTRROLLER.
- IGNITION IN "RUN."
- REPEAT MEASUREMENT OF STEP (2).
- IS BATTERY VOLTAGE MEASURED AT EITHER TERMINAL "A" OR "G"?

0 OHMS

BETWEEN 9000 AND 11000 OHMS

INFINITE

- DISCONNECT ABS CONTROLLER.
- MEASURE RESISTANCE ACROSS TERMINALS "A" AND "G" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.

A

CONTINUED ON PAGE 113

B

CONTINUED ON PAGE 115

YES

REPAIR SHORT TO BATTERY IN Y70 OR U68.

NO

REPLACE ABS CONTROLLER.

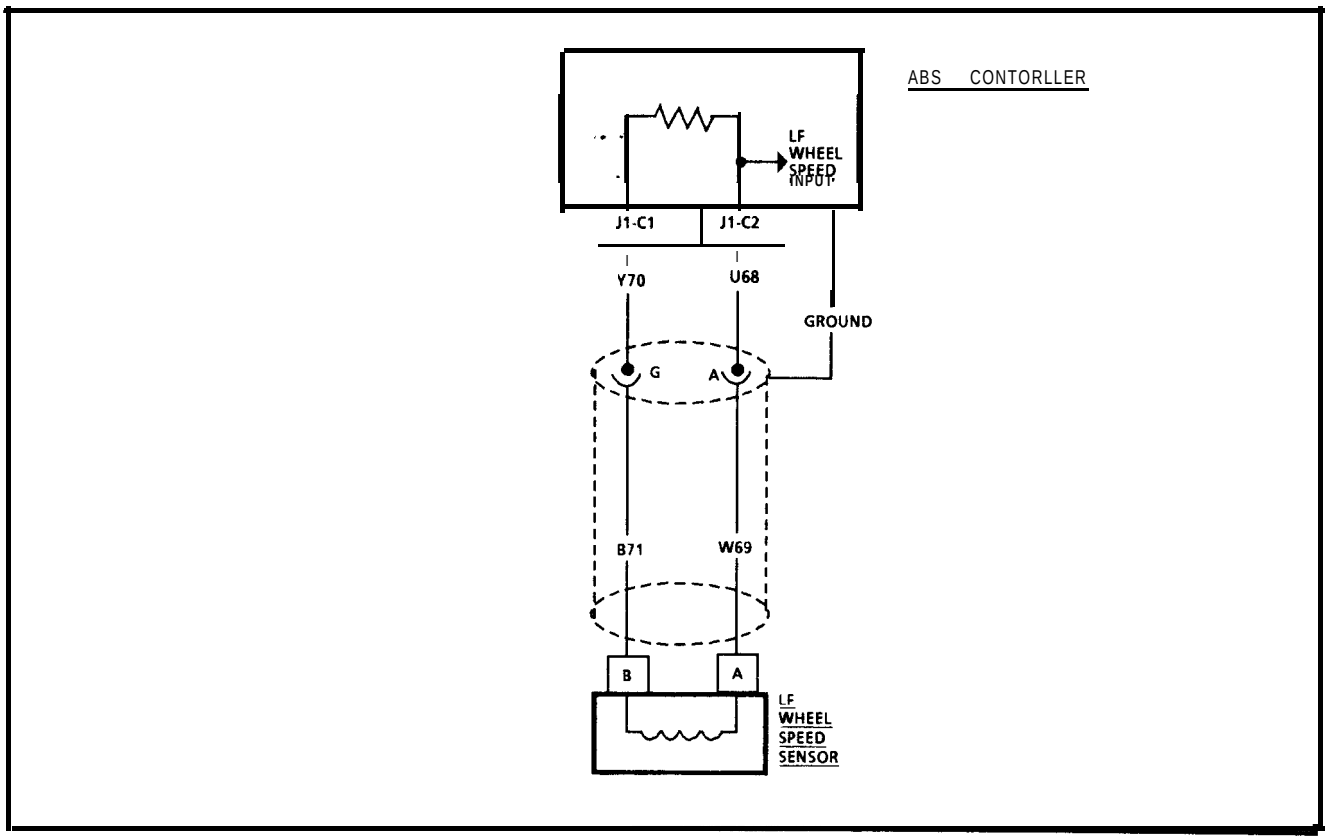
0 OHMS

REPAIR SHORT BETWEEN Y70 AND U68.

INFINITE

CHECK FOR CLEAN TERMINAL CONTACT AT ABS CONTROLLER. REPLACE CONTROLLER IF TERMINAL IS GOOD.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A045

LEFT FRONT WHEEL SPEED = 0

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

5. If more than 10 ohms is measured the circuits between the ABS Controller and the male half of the Wheel Speed Sensor Harness Connector are OK. This isolates the fault to be between the Wheel Speed Sensor and the female half of the Wheel Speed Sensor Harness Connector. Since this area of circuit is exposed to the elements and road debris, it should be carefully inspected for damage.
6. This procedure isolates the fault to a short to ground (998 to 1208 ohms) or open (above 1208 ohms) or a shorted sensor circuit (below 998 ohms).
7. & 8. Determines if the fault is in the harness or the Wheel Speed Sensor. If the harness between the Wheel Speed Sensor Harness Connector in the front luggage compartment and the Wheel Speed Sensor is defective, replace it. Do not attempt to repair it.

CODE A045

LEFT FRONT WHEEL SPEED = 0

CONTINUED FROM PAGE 111

(A)

⑤ • MEASURE RESISTANCE BETWEEN TERMINAL "A" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND, AND THEN MEASURE RESISTANCE BETWEEN TERMINAL "G" AND GROUND.
• WAS EITHER MEASURMENT LESS THAN 10 OHMS ?

NO

⑥ • MEASURE RESISTANCE ACROSS TERMINALS "A" AND "G" ON FEMALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.

ABOVE 1208 OHMS OR BELOW 998 OHMS

⑧ . DISCONNECT LF WHEEL SPEED SENSOR.
• MEASURE RESISTANCE ACROSS WHEEL SPEED SENSOR.

ABOVE 1208 OHMS OR BELOW 998 OHMS

CLEAN WHEEL SPEED SENSOR TERMINALS OF ANY MOISTURE, CORROSION, DIRT, ETC. RECHECK RESISTANCE ACROSS WHEEL SPEED SENSOR. IF RESISTANCE STILL MEASURES ABOVE 1208 OHMS OR BELOW 998 OHMS, REPLACE LF WHEEL SPEED SENSOR.

BETWEEN 998 AND 1208 OHMS

REPLACE HARNESS BETWEEN WHEEL SPEED SENSOR HARNESS CONNECTOR AND SPEED SENSOR.

BETWEEN 998 AND 1208 OHMS

⑦ • DISCONNECT LF WHEEL SPEED SENSOR.
• MEASURE RESISTANCE BETWEEN TERMINAL "A" AT WHEEL SPEED SENSOR AND GROUND.

INFINITE

REPLACE HARNESS BETWEEN WHEEL SPEED SENSOR HARNESS CONNECTOR AND SPEED SENSOR.

1 MEGOHM OR LESS

REPLACE LF WHEEL SPEED SENSOR.

YES

. DISCONNECT ABS CONTROLLER.
. REPEAT MEASUREMENT OF STEP ⑤.
• WAS EITHER MEASUREMENT LESS THAN 10 OHMS ?

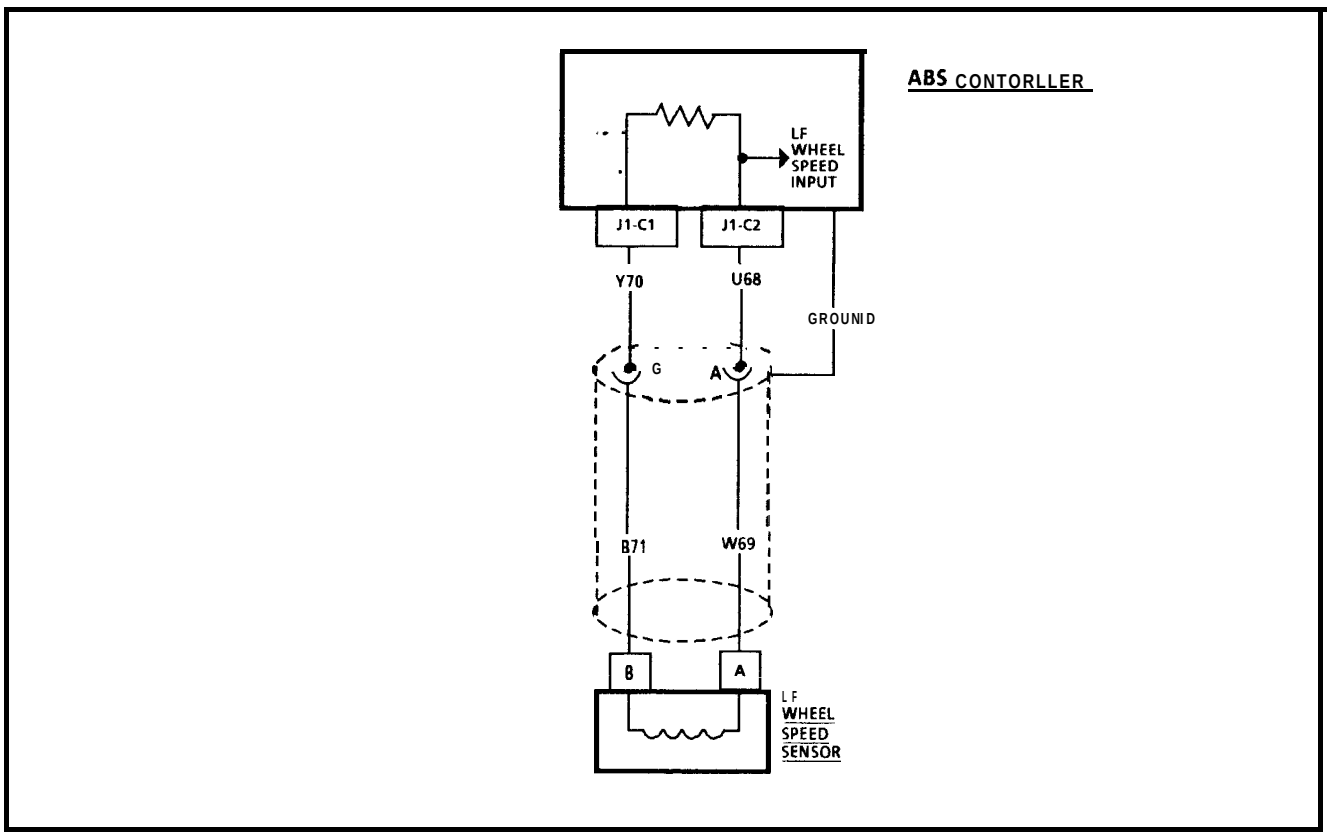
YES

REPAIR SHORT TO GROUND IN Y70 OR U68.

NO

REPLACE ABS CONTROLLER.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE,CLEAR CODES AND VERIFY OPERATION.



CODE A045

LEFT FRONT WHEEL SPEED = 0

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

10. With male of Y70 connected to ground, the resistance from Terminal "Jl-Cl" to ground should be zero. If infinite resistance is measured, an open condition is indicated in Y70.
11. With male of U68 connected to ground, the resistance from Terminal "J1-C2" to ground should be zero. If infinite resistance is measured, an open condition is indicated in U68.

CODE A045

LEFT FRONT WHEEL SPEED = 0

CONTINUED FROM PAGE 111

B

10

- CONNECT JUMPER BETWEEN TERMINAL "G" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND.
- DISCONNECT ABS CONTROLLER.
- MEASURE RESISTANCE BETWEEN TERMINAL "J1-C1" OF ABS CONTROLLER HARNESS CONNECTOR AND GROUND.

0 OHMS

INFINITE

REPAIR OPEN IN Y70.

1

- CONNECT JUMPER BETWEEN TERMINAL "A" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND.
- MEASURE RESISTANCE BETWEEN TERMINAL "J1-C2" OF ABS CONTROLLER HARNESS CONNECTOR AND GROUND.

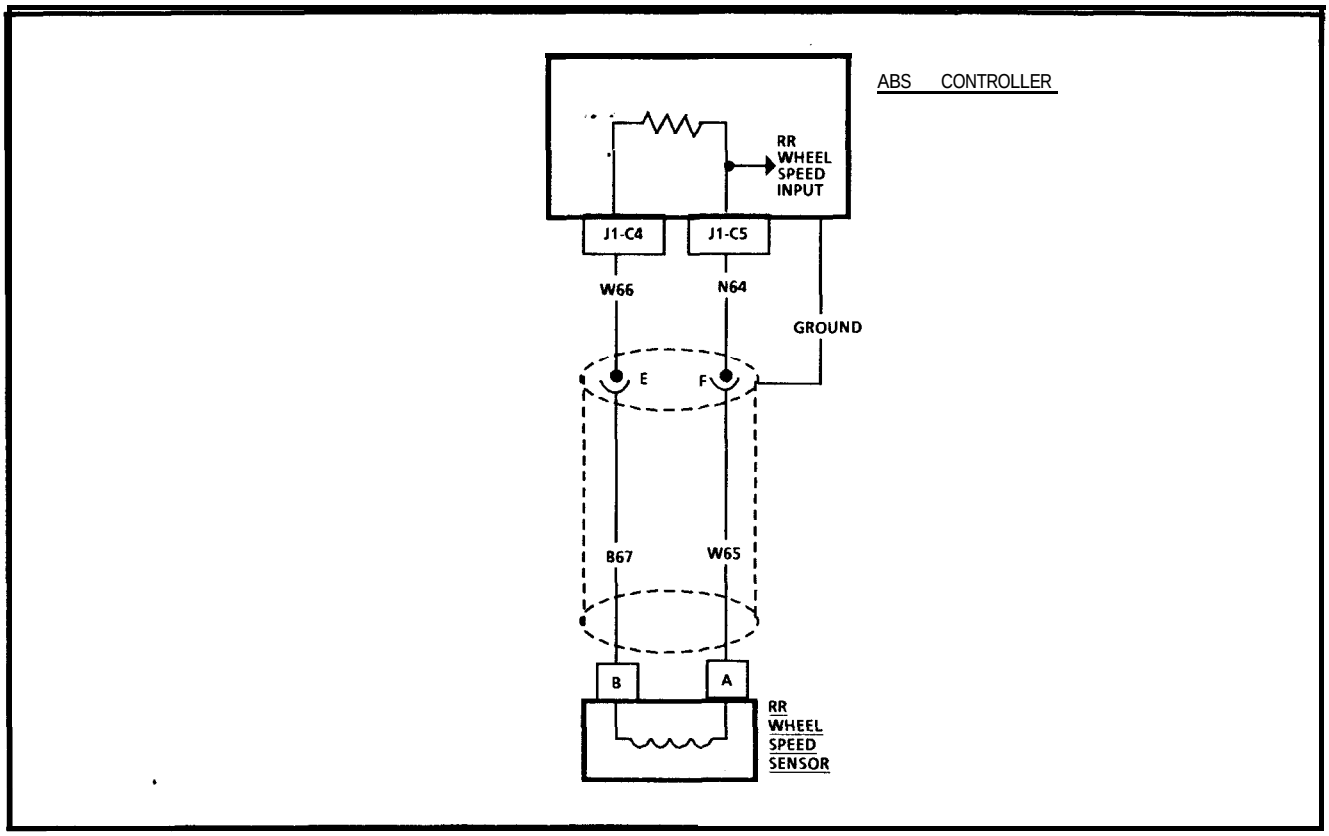
0 OHMS

INFINITE

CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER, REPLACE ABS CONTROLLER IF CONTACT IS GOOD.

REPAIR OPEN IN U68.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A046

RIGHT REAR WHEEL SPEED = 0

The Wheel Speed Sensor generates a signal that indicates the speed of the wheel. Voltage pulses are produced as the magnetic teeth pass the coil. The frequency of this AC voltage is used by the ABS Controller to determine how fast the wheel is turning. By comparing this wheel speed to the other wheel speeds, the ABS Controller can detect if wheel lock-up is about to occur.

CODE A047 will set when all of the following conditions exist:

- The ABS Controller senses the right rear wheel speed to be 0 mph.
- The ABS Controller senses that the other three wheel speeds are greater than 5 mph and are operating correctly.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

I. Observation of erratic or no wheel speed input indicates the fault is present and is not intermittent.

2. & 3. Step 2 determines if a short to battery is the fault. If battery voltage is measured step 3 isolates the short to the harness or controller.

4. If 9000 to 11000 ohms was measured, its possibility of a open or short in the circuit between the ABS Controller and the male half of the Wheel Speed Sensor Harness Connector has been eliminated.

CODE A046

RIGHT REAR WHEEL SPEED = 0

(1)
- IGNITION IN "RUN".
- ENTER DATA LIST (TECH 1 MODE FO).
- MONITOR RIGHT REAR WHEEL SPEED WHILE GRADUALLY DECELERATING FROM 25 MPH TO 0 MPH.

ERRATIC OR NO WHEEL SPEED OBSERVED

STEADY WHEEL SPEED OBSERVED THAT DECREASES AT A STEADY RATE AS THE WHEEL SLOWS TO A STOP.

FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

(2)
- IGNITION IN "OFF".
- DISCONNECT THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT.
- IGNITION IN "RUN".
- CHECK FOR VOLTAGE BETWEEN TERMINAL "F" ON THE MALE HALF OF THE WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND, AND THEN CHECK FOR VOLTAGE BETWEEN TERMINAL "E" AND GROUND.
- IS BATTERY VOLTAGE MEASURED AT EITHER TERMINAL "E" OR "F"?

NOTE: NORMAL INDICATION I5 APPROX. 2.5 VOLT DC.

NO

(4)
- IGNITION "OFF."
- MEASURE RESISTANCE ACROSS TERMINALS "F" AND "E" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.

0 OHMS

- DISCONNECT ABS CONTROLLER.
- MEASURE RESISTANCE ACROSS TERMINALS "F" AND "E" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.

0 OHMS

REPAIR SHORT BETWEEN N64 AND W66.

INFINITE

CHECK FOR CLEAN TERMINAL CONTACT AT ABS CONTROLLER. REPLACE CONTROLLER IF TERMINAL IS GOOD.

BETWEEN 9000 AND 11000 OHMS

A

CONTINUED ON PAGE 119

INFINITE

B

CONTINUED ON PAGE 121

YES

(3)
- IGNITION "OFF."
- DISCONNET ABS CONTRROLLER.
- IGNITION IN "RUN."
- REPEAT MEASUREMENT OF STEP (2).
- IS BATTERY VOLTAGE MEASURED AT EITHER TERMINAL "E" OR "F"?

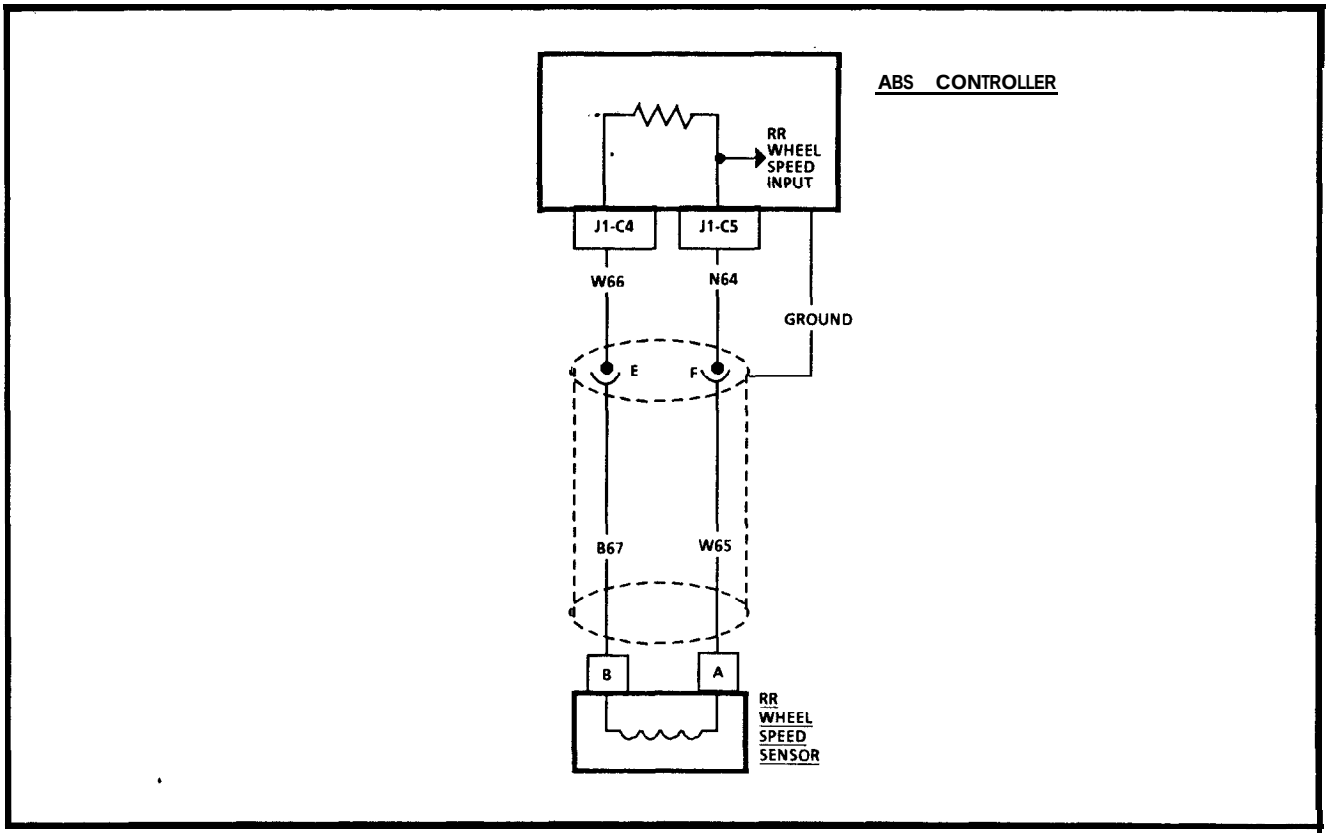
YES

REPAIR SHORT TO BATTERY IN N64 OR W66.

NO

REPLACE ABS CONTROLLER

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, I5 GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A046

RIGHT REAR WHEEL SPEED = 0

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

5. If more than 10 ohms is measured the circuits between the ABS Controller and the male half of the Wheel Speed Sensor Harness Connector are OK. This isolates the fault to be between the Wheel Speed Sensor and the female half of the Wheel Speed Sensor Harness Connector. Since this area of circuit is exposed to the elements and road debris, it should be carefully inspected for damage.

6. This procedure isolates the fault to a short to ground (998 to 1208 ohms) or open (above 1208 ohms) or a shorted sensor circuit (below 998 ohms).

7. & 8. Determines if the fault is in the harness or the Wheel Speed Sensor. If the harness between the Wheel Speed Sensor Harness Connector in the front luggage compartment and the Wheel Speed Sensor is defective, replace it. Do not attempt to repair it.

CODE A046

RIGHT REAR WHEEL SPEED = 0

CONTINUED FROM PAGE 117

A

⑤ • MEASURE RESISTANCE BETWEEN TERMINAL "F" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND, AND THEN MEASURE RESISTANCE BETWEEN TERMINAL "E" AND GROUND.
• WAS EITHER MEASURMENT LESS THAN 10 OHMS ?

NO

⑥ • MEASURE RESISTANCE ACROSS TERMINALS "E" AND "F" ON FEMALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.

ABOVE 1208 OHMS OR BELOW 998 OHMS

⑧ • DISCONNECT RR WHEEL SPEED SENSOR.
• MEASURE RESISTANCE ACROSS WHEEL SPEED SENSOR.

ABOVE 1208 OHMS OR BELOW 998 OHMS

CLEAN WHEEL SPEED SENSOR TERMINALS OF ANY MOISTURE, CORROSION, DIRT, ETC. RECHECK RESISTANCE ACROSS WHEEL SPEED SENSOR. IF RESISTANCE STILL MEASURES ABOVE 1208 OHMS OR BELOW 998 OHMS, REPLACE RR WHEEL SPEED SENSOR.

BETWEEN 998 AND 1208 OHMS

⑦ . DISCONNECT RR WHEEL SPEED SENSOR.
• MEASURE RESISTANCE BETWEEN TERMINAL "A" AT WHEEL SPEED SENSOR AND GROUND.

INFINITE

REPLACE HARNESS BETWEEN WHEEL SPEED SENSOR HARNESS CONNECTOR AND SPEED SENSOR.

1 MEGOHM OR LESS

REPLACE RR WHEEL SPEED SENSOR.

BETWEEN 998 AND 1208 OHMS

REPLACE HARNESS BETWEEN WHEEL SPEED SENSOR HARNESS CONNECTOR AND SPEED SENSOR.

YES

. DISCONNECT ABS CONTROLLER.
• REPEAT MEASUREMENT OF STEP ⑤.
• WAS EITHER MEASUREMENT LESS THAN 10 OHMS ?

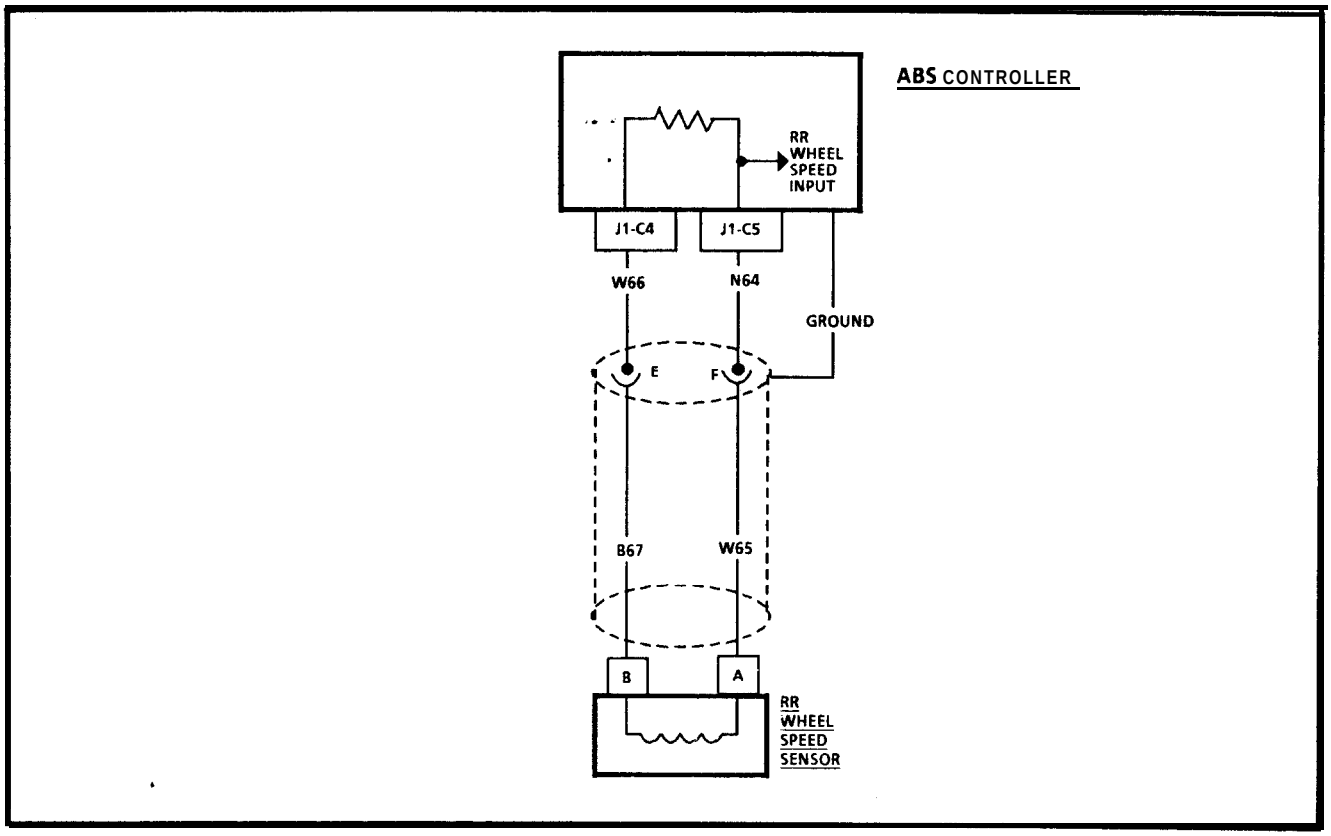
YES

REPAIR SHORT TO GROUND IN N64 OR W66.

NO

REPLACE ABS CONTROLLER.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A046

RIGHT REAR WHEEL SPEED = 0

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

10. With male of N64 connected to ground, the resistance from Terminal "J1-C5" to ground should be zero. If infinite resistance is measured, an open condition is indicated in N64.
11. With male of W66 connected to ground, the resistance from Terminal "Jl-C4" to ground should be zero. If infinite resistance is measured, an open condition is indicated in W66.

CODE A047
LEFT REAR WHEEL SPEED = 0

CONTINUED FROM PAGE 123

A

5 • MEASURE RESISTANCE BETWEEN TERMINAL **"H"** ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND, AND THEN MEASURE RESISTANCE BETWEEN TERMINAL **"B"** AND GROUND.
• WAS EITHER MEASURMENT LESS THAN 10 OHMS ?

NO

6 • MEASURE RESISTANCE ACROSS TERMINALS **"H"** AND "B" ON FEMALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.

ABOVE 1208 OHMS OR BELOW 998 OHMS

• DISCONNECT LR WHEEL SPEED SENSOR.
• MEASURE RESISTANCE ACROSS WHEEL SPEED SENSOR.

BETWEEN 998 AND 1208 OHMS

7 . DISCONNECT LR WHEEL SPEED SENSOR.
. MEASURE RESISTANCE BETWEEN **TERMINAL "A"** AT WHEEL SPEED SENSOR AND GROUND.

INFINITE

REPLACE HARNESS BETWEEN WHEEL SPEED SENSOR HARNESS CONNECTOR AND SPEED SENSOR.

1 **MEGOHM** OR LESS

REPLACE LR WHEEL SPEED SENSOR.

ABOVE 1208 OHMS OR BELOW 998 OHMS

CLEAN WHEEL SPEED SENSOR TERMINALS OF ANY MOISTURE, CORROSION, **DIRT,ETC.** RECHECK RESISTANCE ACROSS WHEEL SPEED SENSOR. IF RESISTANCE STILL MEASURES ABOVE 1208 OHMS OR BELOW 998 OHMS, REPLACE LR WHEEL SPEED SENSOR.

BETWEEN 998 AND 1208 OHMS

REPLACE HARNESS BETWEEN WHEEL SPEED SENSOR HARNESS CONNECTOR AND SPEED SENSOR.

YES

. DISCONNECT ABS CONTROLLER.
• REPEAT MEASUREMENT OF STEP ⑤.
. WAS EITHER MEASUREMENT LESS THAN 10 OHMS ?

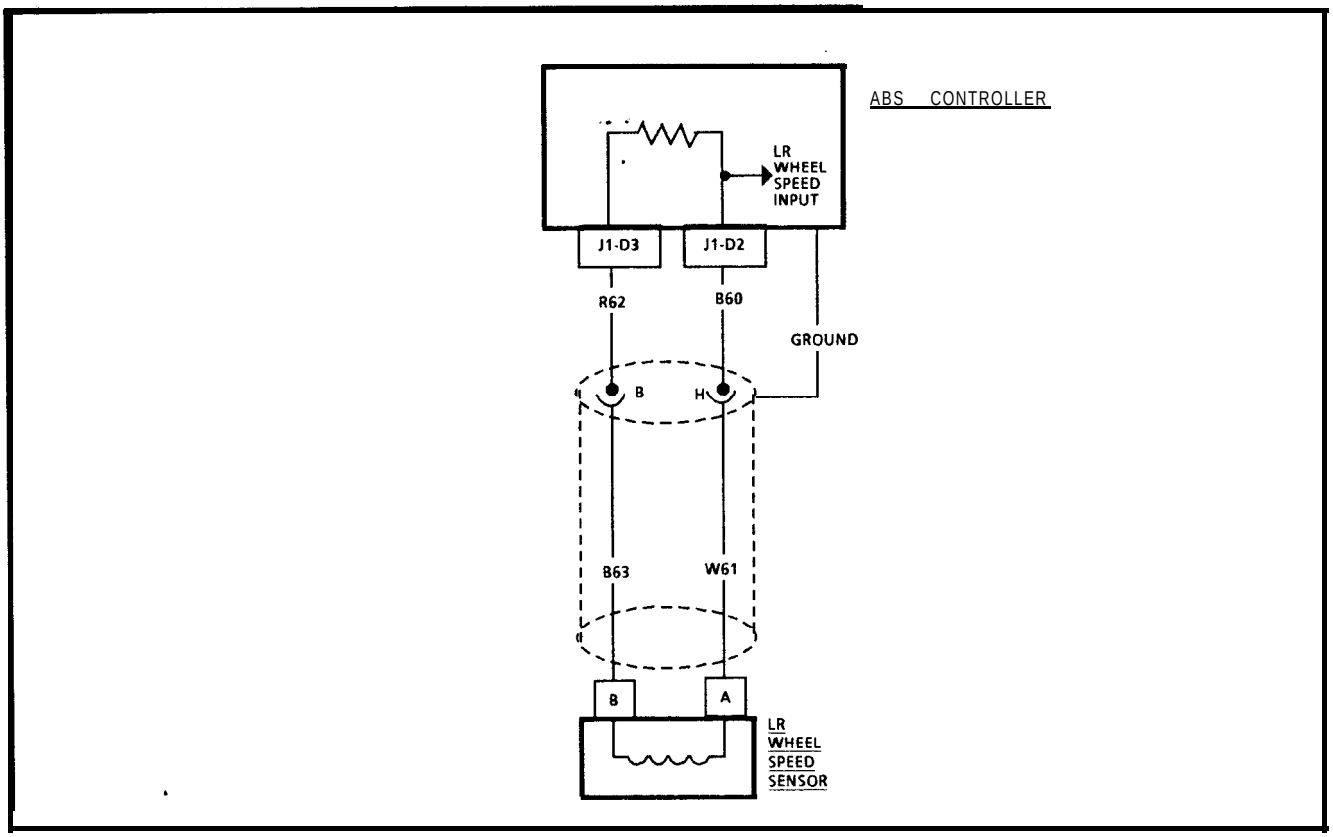
YES

REPAIR SHORT TO GROUND IN B60 OR R62.

NO

REPLACE ABS CONTROLLER.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A047

LEFT REAR WHEEL SPEED = 0

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

10. With Male of B60 connected to ground, the resistance from Terminal "J1-D2" to ground should be zero. If infinite resistance is measured, an open condition is indicated in B60.
11. With Male of R62 connected to ground, the resistance from Terminal "J1-D3" to ground should be zero. If infinite resistance is measured, an open condition is indicated in R62.

CODE A047

LEFT REAR WHEEL SPEED = 0

CONTINUED FROM PAGE 123

B

(1)

- CONNECTJUMPER BETWEEN TERMINAL "H" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND.
- DISCONNECT ABS CONTROLLER.
- MEASURE RESISTANCE BETWEEN TERMINAL "JI-02" OF ABS CONTROLLER HARNESS CONNECTOR AND GROUND.

0 OHMS

INFINITE

REPAIR OPEN IN B60.

(1)

- CONNECT JUMPER BETWEEN TERMINAL "B" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND.
- MEASURE RESISTANCE BETWEEN TERMINAL "J1-03" OF ABS CONTROLLER HARNESS CONNECTOR AND GROUND.

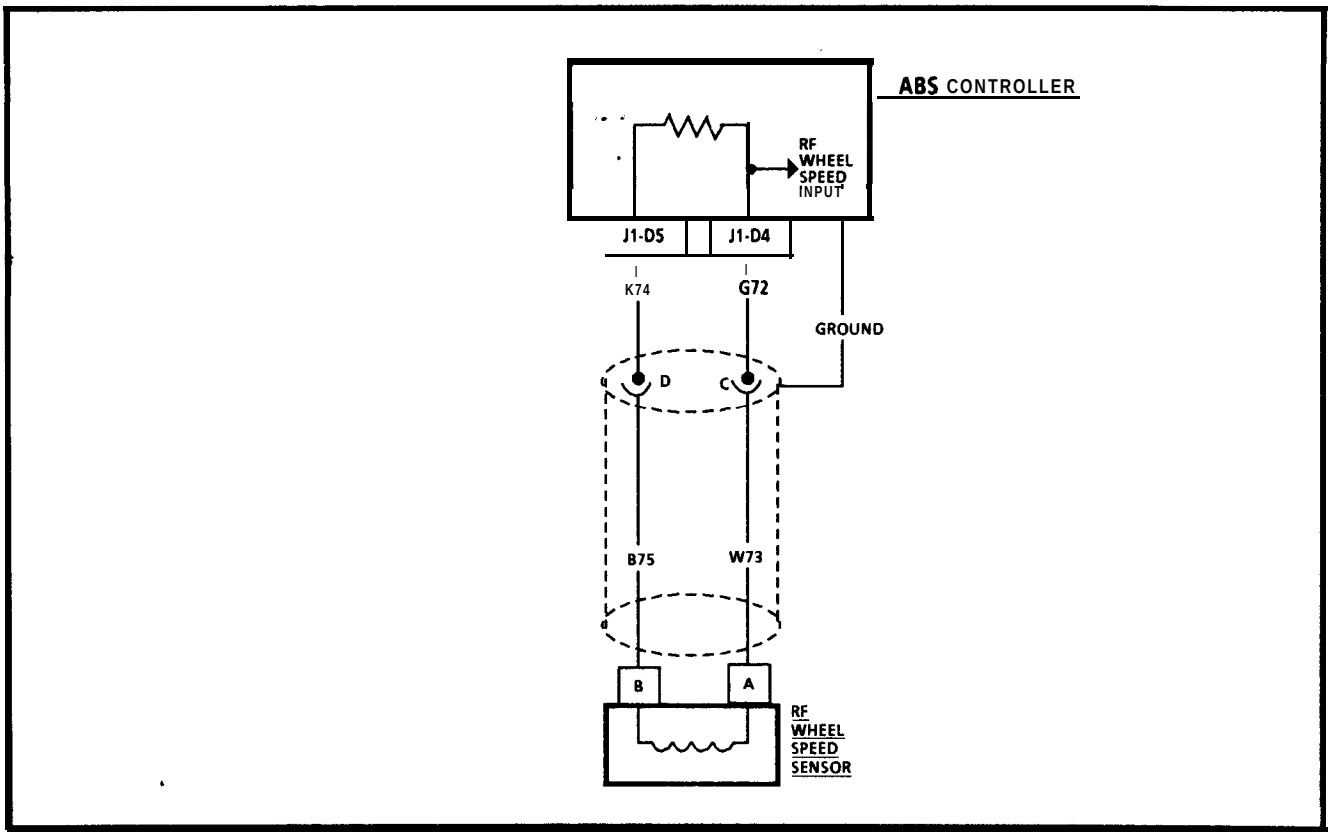
0 OHMS

INFINITE

CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER, REPLACE ABS CONTROLLER IF CONTACT IS GOOD.

REPAIR OPEN IN R62.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. 00 NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A048

EXCESSIVE RIGHT FRONT WHEEL ACCELERATION

The ABS Controller uses the signal from the wheel speed sensor to detect if wheel lock-up is impending. If the frequency of the AC voltage produced by the wheel speed sensor indicates that the wheel is accelerating or decelerating faster than physically possible, the ABS Controller determines the signal is faulty and sets the code.

CODE A048 will set when all of the following conditions exist:

- The Brakes are not being applied (Brake Switch is off).
- The ABS Controller senses that the Right Front Wheel has accelerated or decelerated greater than physically possible.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. Observation of erratic or no wheel speed input indicates the fault is present and is not intermittent.

2.& 3. Step 2 determines if a short to battery is the fault. If battery voltage is measured, Step 3 isolates the short to the harness or controller.

4. If 9000 to 11000 ohms is measured, the possibility of an open or short in the circuit between the ABS Controller and the male half of Wheel Speed Sensor Harness Connector is eliminated.

CODE A048

EXCESSIVE RIGHT FRONT WHEEL ACCELERATION

(1)
- IGNITION IN "RUN"
- ENTER DATA LIST (TECH 1 MODE FO).
- MONITOR RIGHT FRONT WHEEL SPEED WHILE GRADUALLY DECELERATING FROM 25 MPH TO 0 MPH.

ERRATIC OR NO WHEEL SPEED OBSERVED

STEADY WHEEL SPEED OBSERVED THAT DECREASES AT A STEADY RATE AS THE WHEEL SLOWS TO A STOP.

FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

(2)
- IGNITION IN "OFF".
- DISCONNECT THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT.
- IGNITION IN "RUN".
- CHECK FOR VOLTAGE BETWEEN TERMINAL "D" ON THE MALE HALF OF THE WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND, AND THEN CHECK FOR VOLTAGE BETWEEN TERMINAL "C" AND GROUND.
- IS BATTERY VOLTAGE MEASURED AT EITHER TERMINAL "C" OR "D"? NOTE: NORMAL INDICATION IS APPROX. 2.5 VOLT DC.

NO

YES

(4)
- IGNITION "OFF."
- MEASURE RESISTANCE ACROSS TERMINALS "C" AND "D" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.

(3)
- IGNITION "OFF."
- DISCONNET ABS CONTRROLLER.
- IGNITION IN "RUN."
- REPEAT MEASUREMENT OF STEP (2).
- IS BATTERY VOLTAGE MEASURED AT EITHER TERMINAL "D" OR "C"?

0 OHMS

- DISCONNECT ABS CONTROLLER.
- MEASURE RESISTANCE ACROSS TERMINALS "C" AND "D" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.

BETWEEN 9000 AND 11000 OHMS

A

CONTINUED ON PAGE 131

INFINITE

B

CONTINUED ON PAGE 133

YES

REPAIR SHORT TO BATTERY IN K74 OR G72.

NO

REPLACE ABS CONTROLLER.

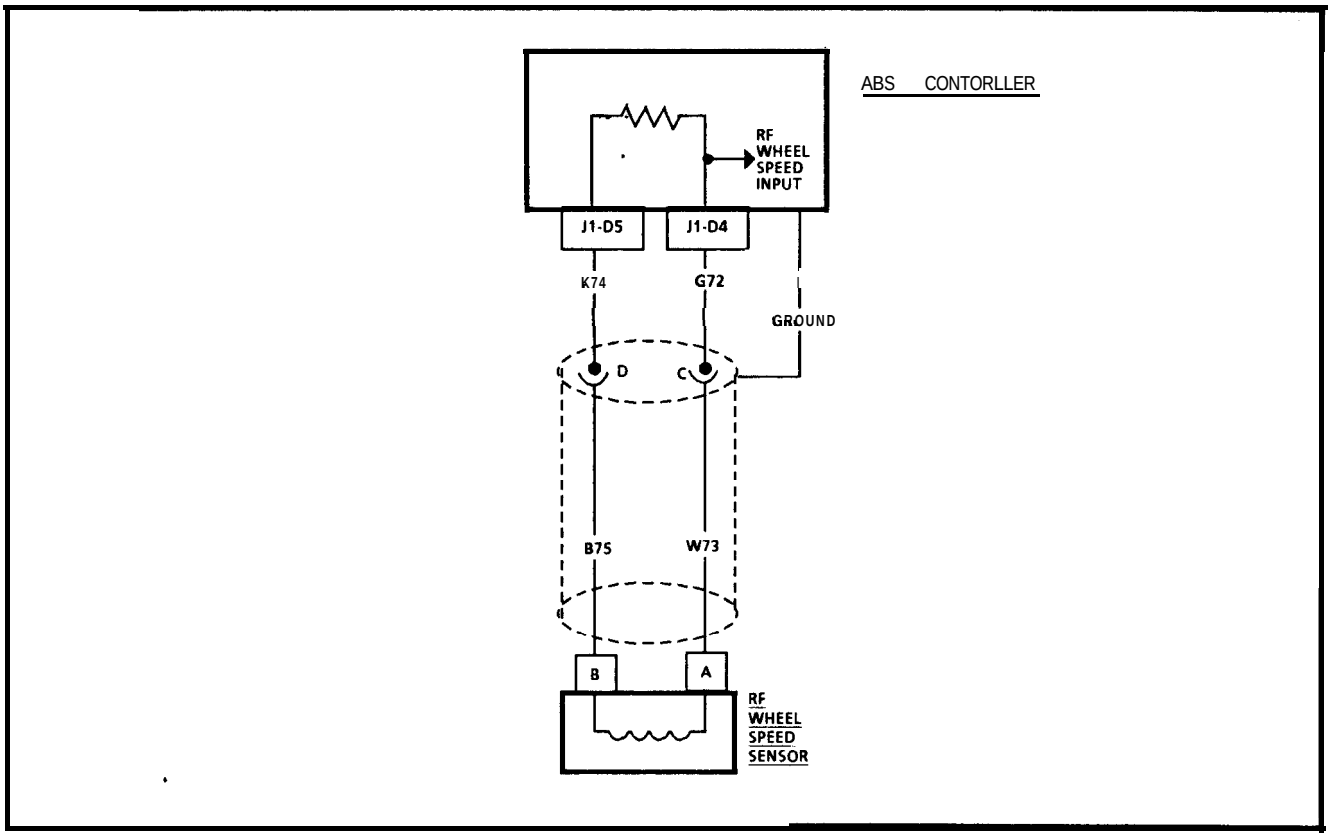
0 OHMS

REPAIR SHORT BETWEEN K74 AND 672.

INFINITE

CHECK FOR CLEAN TERMINAL CONTACT AT ABS CONTROLLER. REPLACE CONTROLLER IF TERMINAL IS GOOD.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A048

EXCESSIVE RIGHT FRONT WHEEL ACCELERATION

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

5. If more than 10 ohms is measured the circuits between the ABS Controller and the male half of the Wheel Speed Sensor Harness Connector are OK. This isolates the fault to be between the Wheel Speed Sensor and the female half of the Wheel Speed Sensor Harness Connector. Since this area of circuit is exposed to the elements and road debris, it should be carefully inspected for damage.
6. This procedure isolates the fault to a short to ground (998 to 1208 ohms) or open (above 1208 ohms) or a shorted sensor circuit (below 998 ohms).
7. & 8. Determines if the fault is in the harness or the Wheel Speed Sensor. If the harness between the Wheel Speed Sensor Harness Connector in the front luggage compartment and the Wheel Speed Sensor is defective, replace it. Do not attempt to repair it.

CODE A048

EXCESSIVE RIGHT FRONT WHEEL ACCELERATION

CONTINUED FROM PAGE 129

4

5 • MEASURE RESISTANCE BETWEEN TERMINAL "D" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND, AND THEN MEASURE RESISTANCE BETWEEN TERMINAL "C" AND GROUND.
• WAS EITHER MEASURMENT LESS THAN 10 OHMS ?

NO

6 • MEASURE RESISTANCE ACROSS TERMINALS "C" AND "D" ON FEMALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.

ABOVE 1208 OHMS OR BELOW 998 OHMS

8 • **DISCONNECT RF WHEEL SPEED SENSOR.**
• **MEASURE RESISTANCE ACROSS WHEEL SPEED SENSOR.**

ABOVE 1208 OHMS OR BELOW 998 OHMS

CLEAN WHEEL SPEED SENSOR TERMINALS OF ANY MOISTURE, CORROSION, DIRT, ETC. RECHECK RESISTANCE ACROSS WHEEL SPEED SENSOR. IF RESISTANCE STILL MEASURES ABOVE 1208 OHMS OR BELOW 998 OHMS, REPLACE RF WHEEL SPEED SENSOR.

BETWEEN 998 AND 1208 OHMS

7 • DISCONNECT RF WHEEL SPEED SENSOR.
• MEASURE RESISTANCE BETWEEN TERMINAL "A" AT WHEEL SPEED SENSOR AND GROUND.

INFINITE

REPLACE HARNESS BETWEEN WHEEL SPEED SENSOR HARNESS CONNECTOR AND SPEED SENSOR.

1 MEGOHM OR LESS

REPLACE RF WHEEL SPEED SENSOR.

BETWEEN 998 AND 1208 OHMS

REPLACE HARNESS BETWEEN WHEEL SPEED SENSOR HARNESS CONNECTOR AND SPEED SENSOR.

YES

• DISCONNECT **ABS** CONTROLLER.
• REPEAT MEASUREMENT OF STEP ⑤.
• WAS EITHER MEASUREMENT LESS **THAN** 10 OHMS ?

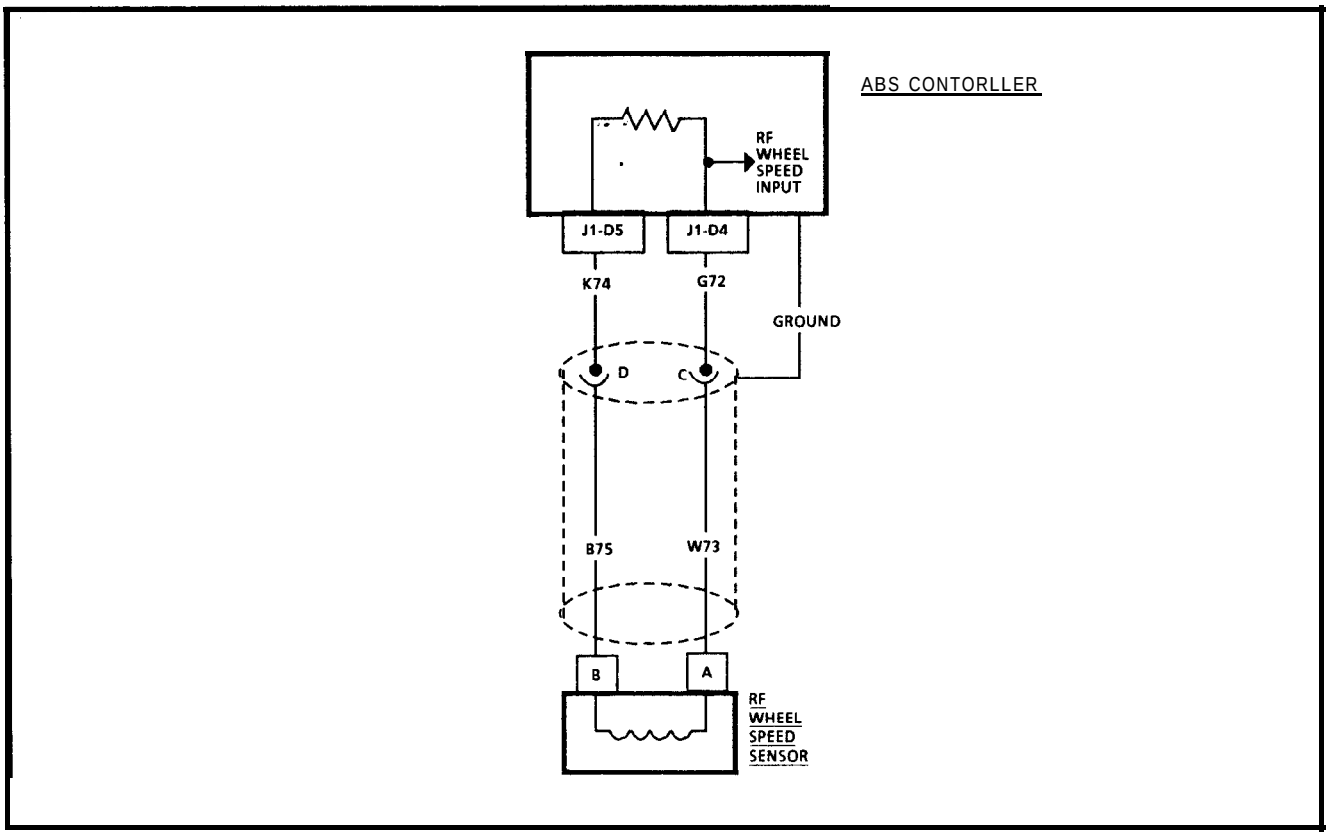
YES

REPAIR SHORT TO GROUND IN K74 OR 672.

NO

REPLACE **ABS** CONTROLLER.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A048

EXCESSIVE RIGHT FRONT WHEEL ACCELERATION

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

10. With male of G72 connected to ground, the resistance from Terminal "Jl-D4" to ground should be zero. If infinite resistance is measured, an open condition is indicated in G72.
11. With male of K74 connected to ground, the resistance from Terminal "J1-D5" to ground should be zero. If infinite resistance is measured, an open condition is indicated in K74.

CODE A048

EXCESSIVE RIGHT FRONT WHEEL ACCELERATION

CONTINUED FROM PAGE 129

B

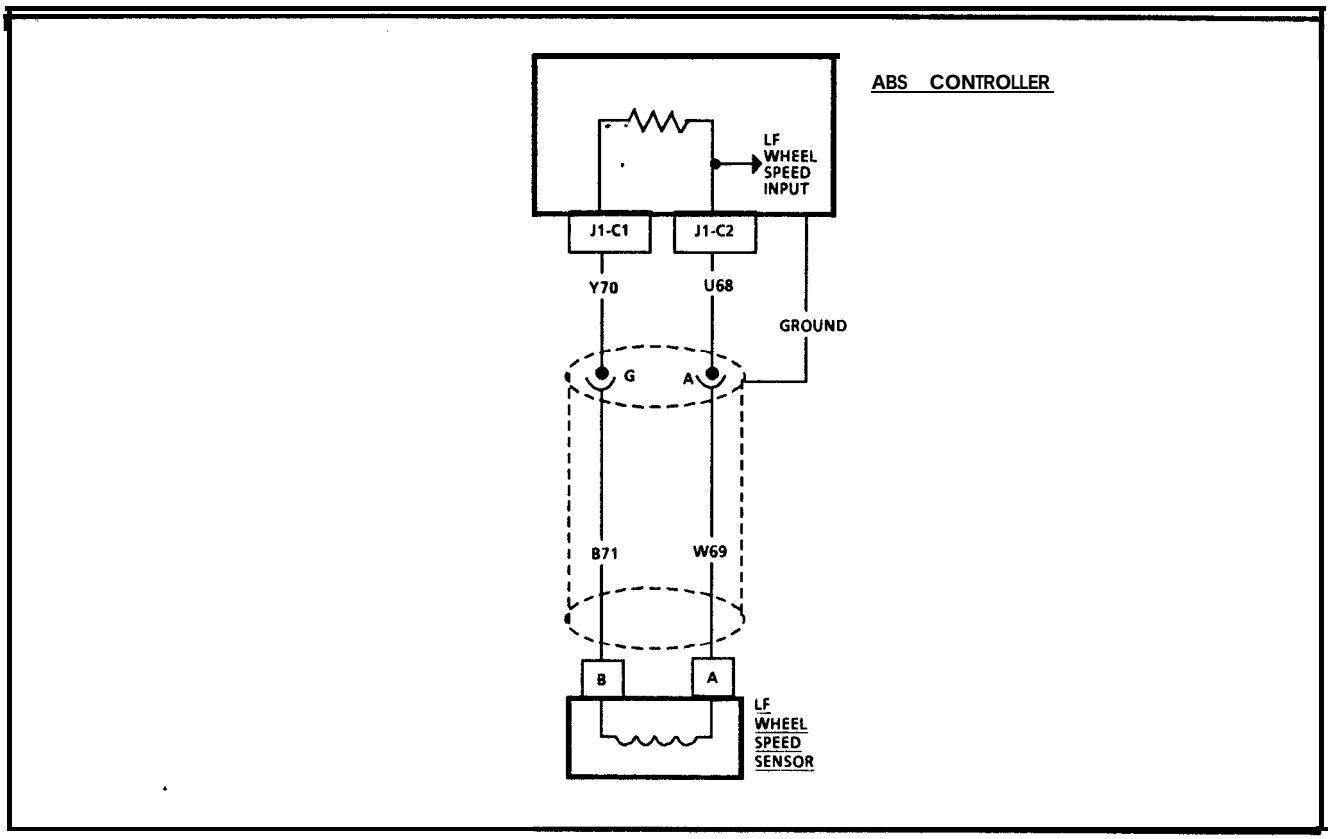
10 • CONNECT JUMPER BETWEEN TERMINAL "C" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND.
• DISCONNECT ABS CONTROLLER.
• MEASURE RESISTANCE BETWEEN TERMINAL "J1-D4" OF ABS CONTROLLER HARNESS CONNECTOR AND GROUND.

- 0 OHMS
- INFINITE → REPAIR OPEN IN G72.

11 • CONNECT JUMPER BETWEEN TERMINAL "D" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND.
• MEASURE RESISTANCE BETWEEN TERMINAL "J1-D5" OF ABS CONTROLLER HARNESS CONNECTOR AND GROUND.

- 0 OHMS → CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER, REPLACE ABS CONTROLLER IF CONTACT IS GOOD.
- INFINITE → REPAIR OPEN IN K74.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, I5 GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A049

EXCESSIVE LEFT FRONT WHEEL ACCELERATION

The ABS Controller uses the signal from the Wheel Speed Sensor to detect if wheel lock-up is impending. If the frequency of the AC voltage produced by the wheel speed sensor indicates that the wheel is accelerating or decelerating faster than physically possible, the Controller determines the signal is faulty and sets the code.

CODE A049 will set when all of the following conditions exist:

- The Brakes are not being applied (Brake Switch is off).
- The ABS Controller senses that the Left Front Wheel has accelerated or decelerated greater than physically possible.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. Observation of erratic or no wheel speed input indicates the fault is present and is not intermittent.

2.& 3. Step 2 determines if a short to battery is the fault. If battery voltage is measured, Step 3 isolates the short to the harness or controller.

4. If 9000 to 11000 ohms is measured, the possibility of an open or short in the circuit between the ABS Controller and the male half of Wheel Speed Sensor Harness Connector is eliminated.

CODE A049

EXCESSIVE LEFT FRONT WHEEL ACCELERATION

(1)
- IGNITION IN "RUN".
- ENTER DATA LIST (TECH 1 MODE FO).
- MONITOR LEFT FRONT WHEEL SPEED WHILE GRADUALLY DECELERATING FROM 25 MPH TO 0 MPH.

ERRATIC OR NO WHEEL SPEED OBSERVED.

STEADY WHEEL SPEED OBSERVED THAT DECREASES AT A STEADY RATE AS THE WHEEL SLOWS TO A STOP.

(2)
- IGNITION IN "OFF".
- DISCONNECT THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT.
- IGNITION IN "RUN".
- CHECK FORVOLTAGE BETWEEN TERMINAL "A" ON THE MALE HALF OF THE WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND, AND THEN CHECK FOR VOLTAGE BETWEEN TERMINAL "G" AND GROUND.
- IS BATTERY VOLTAGE MEASURED AT EITHER TERMINAL "A" OR "G"?

NOTE: NORMAL INDICATION IS APPROX. 2.5 VOLT DC.

FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

NO

YES

(3)
- IGNITION "OFF."
- DISCONNET ABS CONTRROLLER.
- IGNITION IN "RUN."
- REPEAT MEASUREMENT OF STEP (2).
- IS BATTERY VOLTAGE MEASURED AT EITHER TERMINAL "A" OR "G"?

YES

REPAIR SHORT TO BATTERY IN Y70 OR U68.

NO

REPLACE ABS CONTROLLER.

(4)
- IGNITION "OFF."
- MEASURE RESISTANCE ACROSS TERMINALS "A" AND "G" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.

0 OHMS

- DISCONNECT ABS CONTROLLER.
- MEASURE RESISTANCE ACROSS TERMINALS "A" AND "G" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.

0 OHMS

REPAIR SHORT BETWEEN Y70 AND U68.

INFINITE

CHECK FOR CLEAN TERMINAL CONTACT AT ABS CONTROLLER. REPLACE CONTROLLER IF TERMINAL IS GOOD.

BETWEEN 9000 AND 11000 OHMS

A

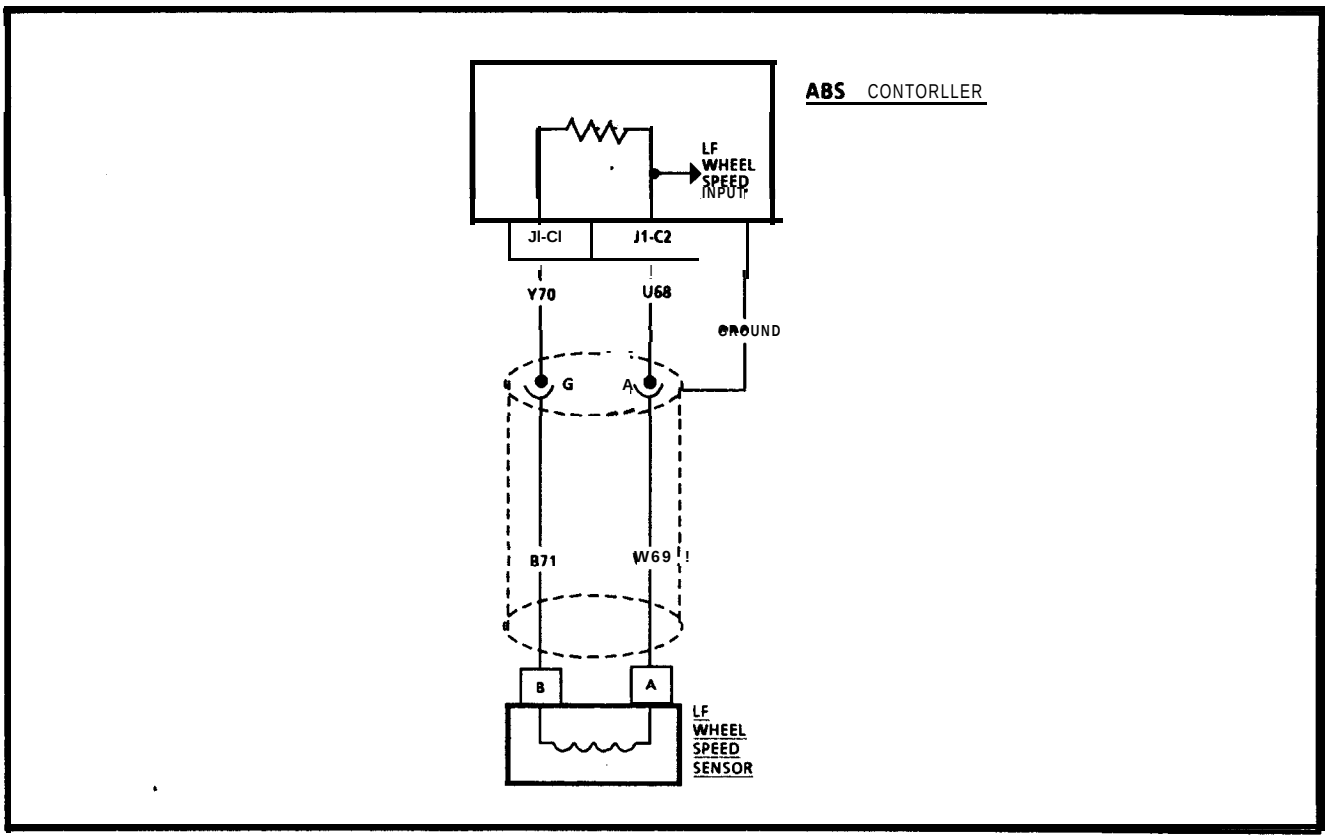
CONTINUED ON PAGE 137

INFINITE

B

CONTINUED ON PAGE 139

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A049

EXCESSIVE LEFT FRONT WHEEL ACCELERATION

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

5. If more than 10 ohms is measured the circuits between the ABS Controller and the male half of the Wheel Speed Sensor Harness Connector are OK. This isolates the fault to be between the Wheel Speed Sensor and the female half of the Wheel Speed Sensor Harness Connector. Since this area of circuit is exposed to the elements and road debris, it should be carefully inspected for damage.
6. This procedure isolates the fault to a short to ground 998 to 1208 ohms) or open (above 1208 ohms) or a shorted sensor circuit (below 998 ohms).
7. & 8. Determines if the fault is in the harness or the Wheel Speed Sensor. If the harness between the Wheel Speed Sensor Harness Connector in the front luggage compartment and the Wheel Speed Sensor is defective, replace it. Do not attempt to repair it.

CODE A049

EXCESSIVE LEFT FRONT WHEEL ACCELERATION

CONTINUED FROM PAGE 135

A

5 • MEASURE RESISTANCE BETWEEN TERMINAL "A" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND, AND THEN MEASURE RESISTANCE BETWEEN TERMINAL "G" AND GROUND.
• WAS EITHER MEASURMENT LESS THAN 10 OHMS ?

YES

. DISCONNECT ABS CONTROLLER
. REPEAT MEASUREMENT OF STEP ⑤.
• WAS EITHER
. MEASUREMENT LESS THAN 10 OHMS ?

YES

REPAIR SHORT TO GROUND IN Y70 OR U68.

NO

REPLACE ABS CONTROLLER.

NO

6 • MEASURE RESISTANCE ACROSS TERMINALS "A" AND "G" ON FEMALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.

ABOVE 1208 OHMS OR BELOW 998 OHMS

8 • DISCONNECT LF WHEEL SPEED SENSOR.
• MEASURE RESISTANCE ACROSS WHEEL SPEED SENSOR.

BETWEEN 998 AND 1208 OHMS

7 . DISCONNECT LF WHEEL SPEED SENSOR.
. MEASURE RESISTANCE BETWEEN TERMINAL "A" AT WHEEL SPEED SENSOR AND GROUND.

INFINITE

REPLACE HARNESS BETWEEN WHEEL SPEED SENSOR HARNESS CONNECTOR AND SPEED SENSOR.

1 MEGOHM OR LESS

REPLACE LF WHEEL SPEED SENSOR.

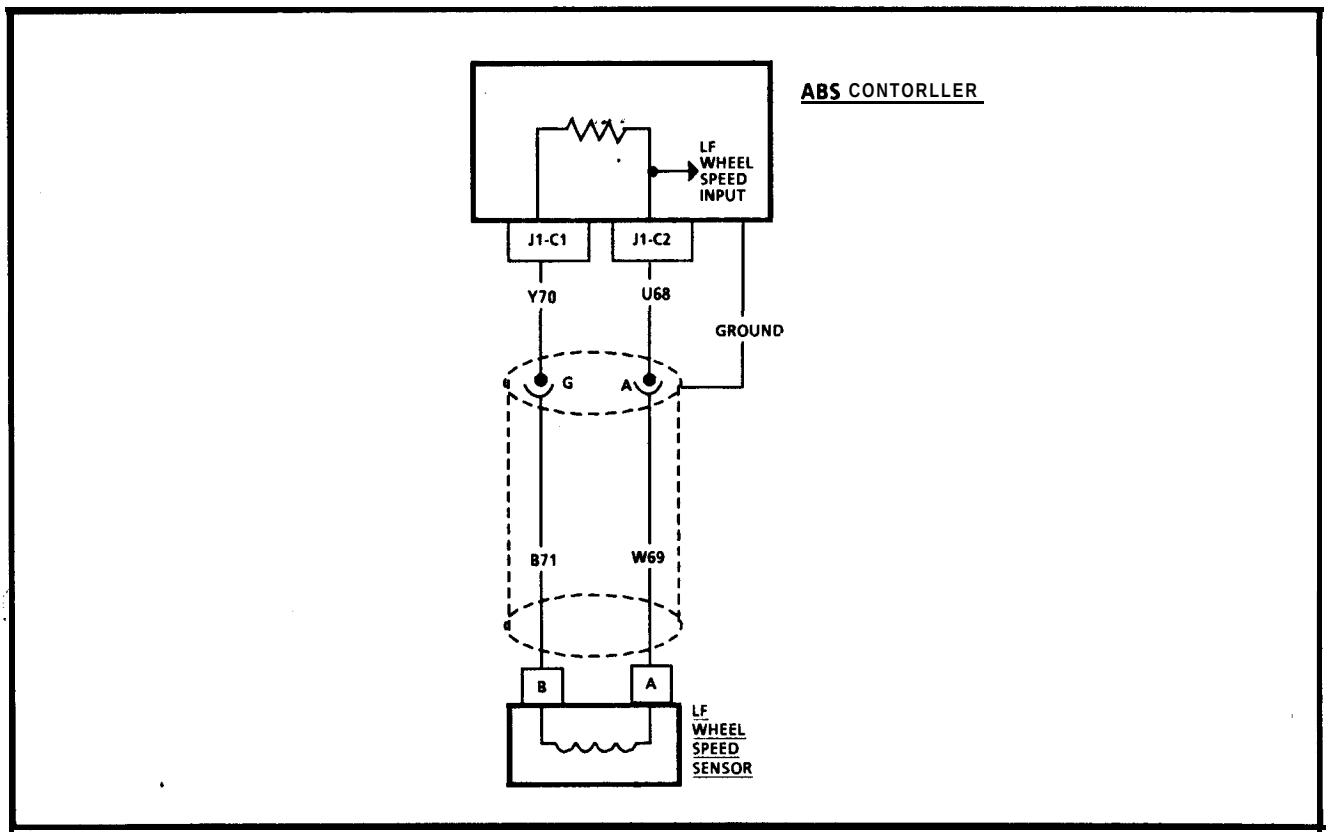
ABOVE 1208 OHMS OR BELOW 998 OHMS

CLEAN WHEEL SPEED SENSOR TERMINALS OF ANY MOISTURE, CORROSION, DIRT, ETC. RECHECK RESISTANCE ACROSS WHEEL SPEED SENSOR. IF RESISTANCE STILL MEASURES ABOVE 1208 OHMS OR BELOW 998 OHMS, REPLACE LF WHEEL SPEED SENSOR.

BETWEEN 998 AND 1208 OHMS

REPLACE HARNESS BETWEEN WHEEL SPEED SENSOR HARNESS CONNECTOR AND SPEED SENSOR.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A049

EXCESSIVE LEFT FRONT WHEEL ACCELERATION

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

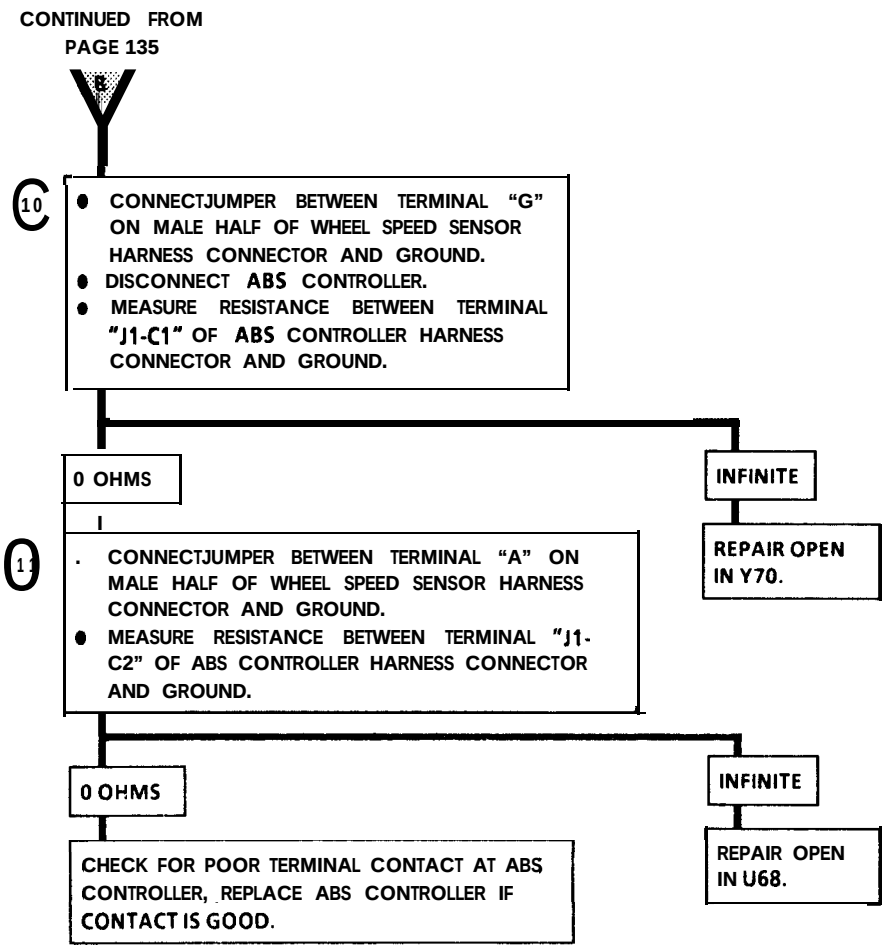
10. With male of Y70 connected to ground, the resistance from Terminal "Jl-Cl" to ground should be zero. If infinite resistance is measured, an open condition is indicated in Y70.

11. With male of U68 connected to ground, the resistance from Terminal "J1-C2" to ground should be zero. If infinite resistance is measured, an open condition is indicated in U68.

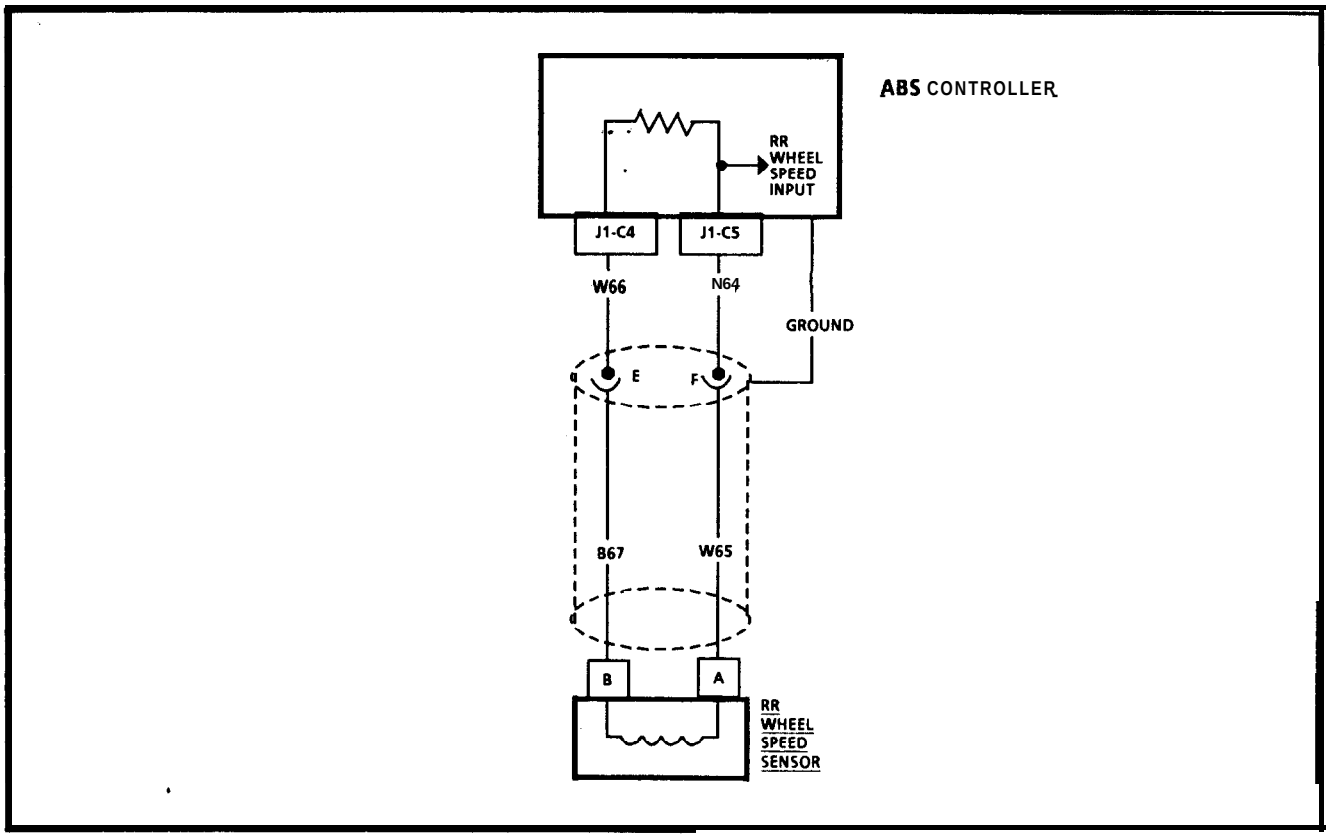
CODE A049

EXCESSIVE LEFT FRONT WHEEL ACCELERATION

CONTINUED FROM PAGE 135


B
10
• CONNECTJUMPER BETWEEN TERMINAL "G" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND.
• DISCONNECT ABS CONTROLLER.
• MEASURE RESISTANCE BETWEEN TERMINAL "J1-C1" OF ABS CONTROLLER HARNESS CONNECTOR AND GROUND.
0 OHMS
INFINITE
REPAIR OPEN IN Y70.
11
. CONNECTJUMPER BETWEEN TERMINAL "A" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND.
• MEASURE RESISTANCE BETWEEN TERMINAL "J1-C2" OF ABS CONTROLLER HARNESS CONNECTOR AND GROUND.
0 OHMS
INFINITE
CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER, REPLACE ABS CONTROLLER IF CONTACT IS GOOD.
REPAIR OPEN IN U68.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A050

EXCESSIVE RIGHT REAR WHEEL ACCELERATION

The ABS Controller uses the signal from the wheel speed sensor to detect if wheel lock-up is impending. If the frequency of the AC voltage produced by the wheel speed sensor indicates that the wheel is accelerating or decelerating faster than physically possible, the Controller determines the signal is faulty and sets the code.

CODE A050 will set when all of the following conditions exist:

- The Brakes are not being applied (Brake Switch is off).
- The ABS Controller senses that the Right Rear Wheel has accelerated or decelerated greater than physically possible.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. Observation of erratic or no wheel speed input indicates the fault is present and is not intermittent.

2.& 3. Step 2 determines if a short to battery is the fault. If battery voltage is measured, Step 3 isolates the short to the harness or controller.

4. If 9000 to 11000 ohms is measured, the possibility of an open or short in the circuit between the ABS Controller and the male half of Wheel Speed Sensor Harness Connector is eliminated.

CODE A050

EXCESSIVE RIGHT REAR WHEEL ACCELERATION

(1)
- IGNITION IN "RUN."
- ENTER DATA LIST (TECH 1 MODE FO).
- MONITOR RIGHT REAR WHEEL SPEED WHILE GRADUALLY DECELERATING FROM 25 MPH TO 0 MPH.

ERRATIC OR NO WHEEL SPEED OBSERVED

STEADY WHEEL SPEED OBSERVED THAT DECREASES AT A STEADY RATE AS THE WHEEL SLOWS TO A STOP.

FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

(2)
- IGNITION IN "OFF".
- DISCONNECT THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT.
- IGNITION IN "RUN".
- CHECK FOR VOLTAGE BETWEEN TERMINAL "F" ON THE MALE HALF OF THE WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND, AND THEN CHECK FOR VOLTAGE BETWEEN TERMINAL "E" AND GROUND.
- IS BATTERY VOLTAGE MEASURED AT EITHER TERMINAL "E" OR "F"?

NOTE: NORMAL INDICATION IS APPROX. 2.5 VOLT DC.

NO

YES

(4)
- IGNITION "OFF."
- MEASURE RESISTANCE ACROSS TERMINALS "F" AND "E" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.

(3)
- IGNITION "OFF."
- DISCONNET ABS CONTRROLLER.
- IGNITION IN "RUN."
- REPEAT MEASUREMENT OF STEP (2).
- IS BATTERY VOLTAGE MEASURED AT EITHER TERMINAL "E" OR "F"?

0 OHMS

BETWEEN 9000 AND 11000 OHMS

INFINITE

YES

NO

- DISCONNECT ABS CONTROLLER.
- MEASURE RESISTANCE ACROSS TERMINALS "F" AND "E" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.

A

CONTINUED ON PAGE 143

B

CONTINUED ON PAGE 145

REPAIR SHORT TO BATTERY IN N64 OR W66.

REPLACE ABS CONTROLLER.

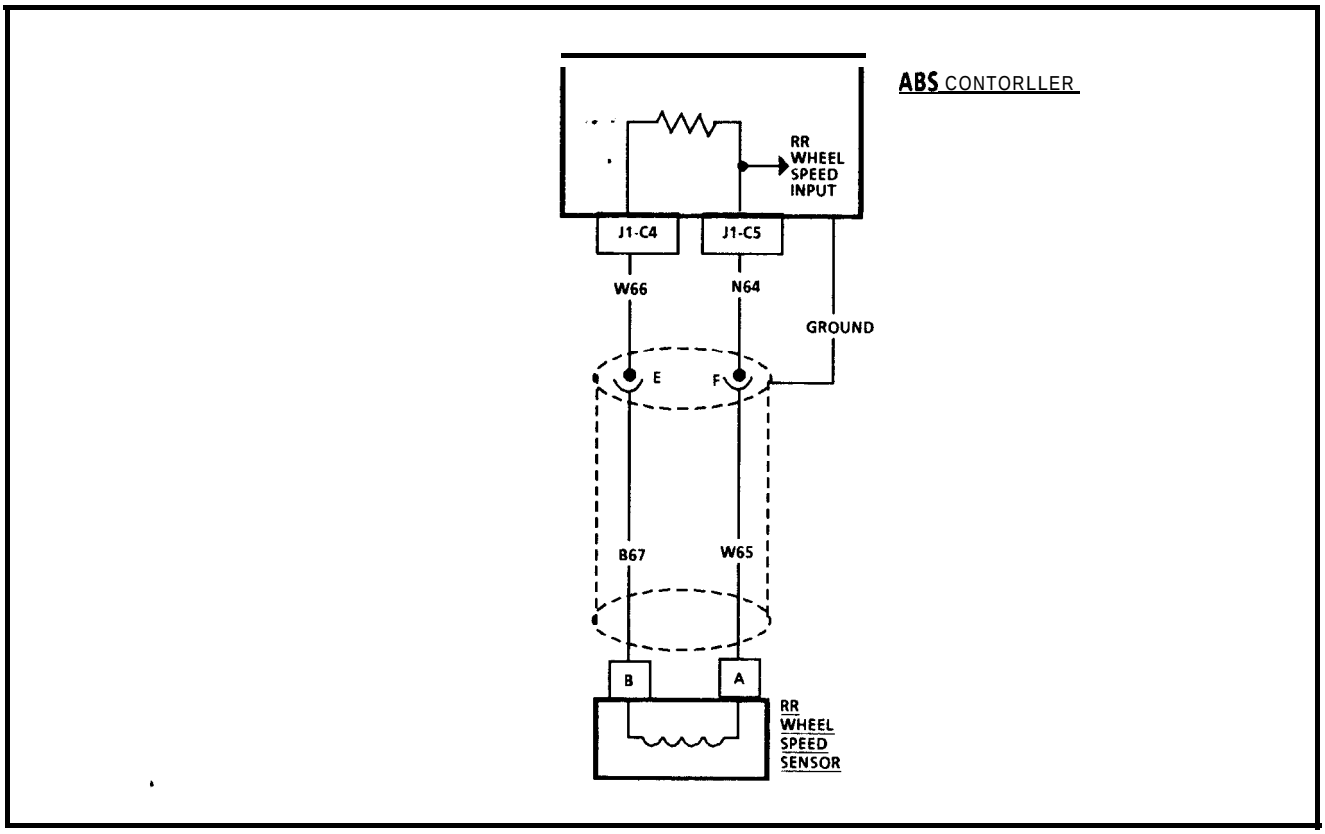
0 OHMS

INFINITE

REPAIR SHORT BETWEEN N64 AND W66.

CHECK FOR CLEAN TERMINAL CONTACT AT ABS CONTROLLER. REPLACE CONTROLLER IF TERMINAL IS GOOD.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A050

EXCESSIVE RIGHT REAR WHEEL SPEED ACCELERATION

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

5. If more than 10 ohms is measured the circuits between the ABS Controller and the male half of the Wheel Speed Sensor Harness Connector are OK. This isolates the fault to be between the Wheel Speed Sensor and the female half of the Wheel Speed Sensor Harness Connector. Since this area of circuit is exposed to the elements and road debris, it should be carefully inspected for damage.
6. This procedure isolates the fault to a short to ground (998 to 1208 ohms) or open (above 1208 ohms) or a shorted sensor circuit (below 998 ohms).
7. & 8. Determines if the fault is in the harness or the Wheel Speed Sensor. If the harness between the Wheel Speed Sensor Harness Connector in the front luggage compartment and the Wheel Speed Sensor is defective, replace it. Do not attempt to repair it.

CODE A050

EXCESSIVE RIGHT REAR WHEEL ACCELERATION

CONTINUED FROM PAGE 141

(4)

(5) ● MEASURE RESISTANCE BETWEEN TERMINAL "F" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND, AND THEN MEASURE RESISTANCE BETWEEN TERMINAL "E" AND GROUND.
● WAS EITHER MEASURMENT LESS THAN 10 OHMS ?

NO

(6) ● MEASURE RESISTANCE ACROSS TERMINALS "E" AND "F" ON FEMALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.

ABOVE 1208 OHMS OR BELOW 998 OHMS

(8) ● DISCONNECT RR WHEEL SPEED SENSOR.
. MEASURE RESISTANCE ACROSS WHEEL SPEED SENSOR.

ABOVE 1208 OHMS OR BELOW 998 OHMS

CLEAN WHEEL SPEED SENSOR TERMINALS OF ANY MOISTURE, CORROSION, DIRT, ETC. RECHECK RESISTANCE ACROSS WHEEL SPEED SENSOR. IF RESISTANCE STILL MEASURES ABOVE 1208 OHMS OR BELOW 998 OHMS, REPLACE RR WHEEL SPEED SENSOR.

BETWEEN 998 AND 1208 OHMS

(9) ● DISCONNECT RR WHEEL SPEED SENSOR.
. MEASURE RESISTANCE BETWEEN TERMINAL "A" AT WHEEL SPEED SENSOR AND GROUND.

INFINITE

REPLACE HARNESS BETWEEN WHEEL SPEED SENSOR HARNESS CONNECTOR AND SPEED SENSOR.

1 MEGOHM OR LESS

REPLACE RR WHEEL SPEED SENSOR.

BETWEEN 998 AND 1208 OHMS

REPLACE HARNESS BETWEEN WHEEL SPEED SENSOR HARNESS CONNECTOR AND SPEED SENSOR.

YES

● DISCONNECT ABS CONTROLLER.
. REPEAT MEASUREMENT OF STEP (5).
. WAS EITHER MEASUREMENT LESS THAN 10 OHMS ?

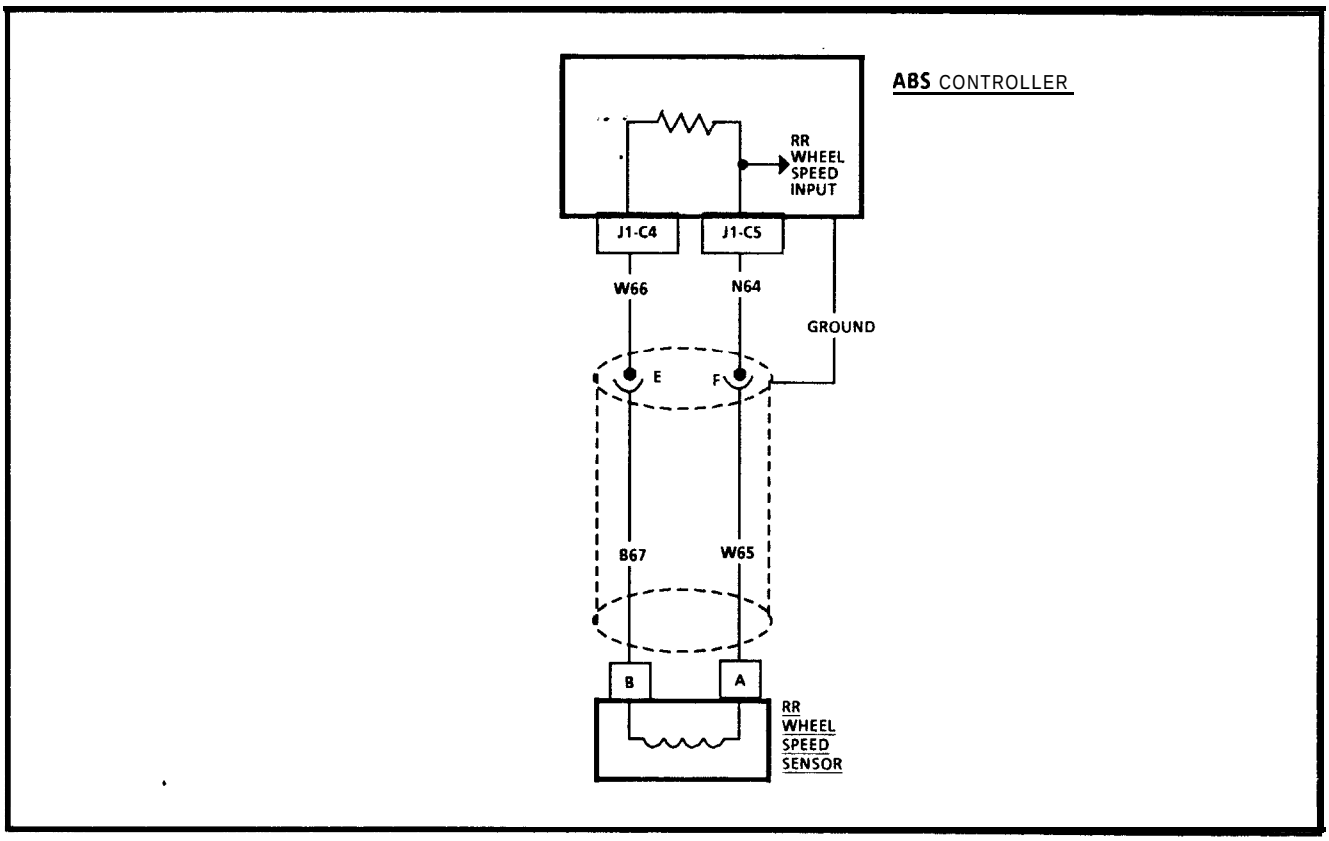
YES

REPAIR SHORT TO GROUND IN N64 OR W66.

NO

REPLACE ABS CONTROLLER.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE,CLEARCODES AND VERIFY OPERATION.



CODE A050

EXCESSIVE RIGHT REAR WHEEL SPEED ACCELERATION

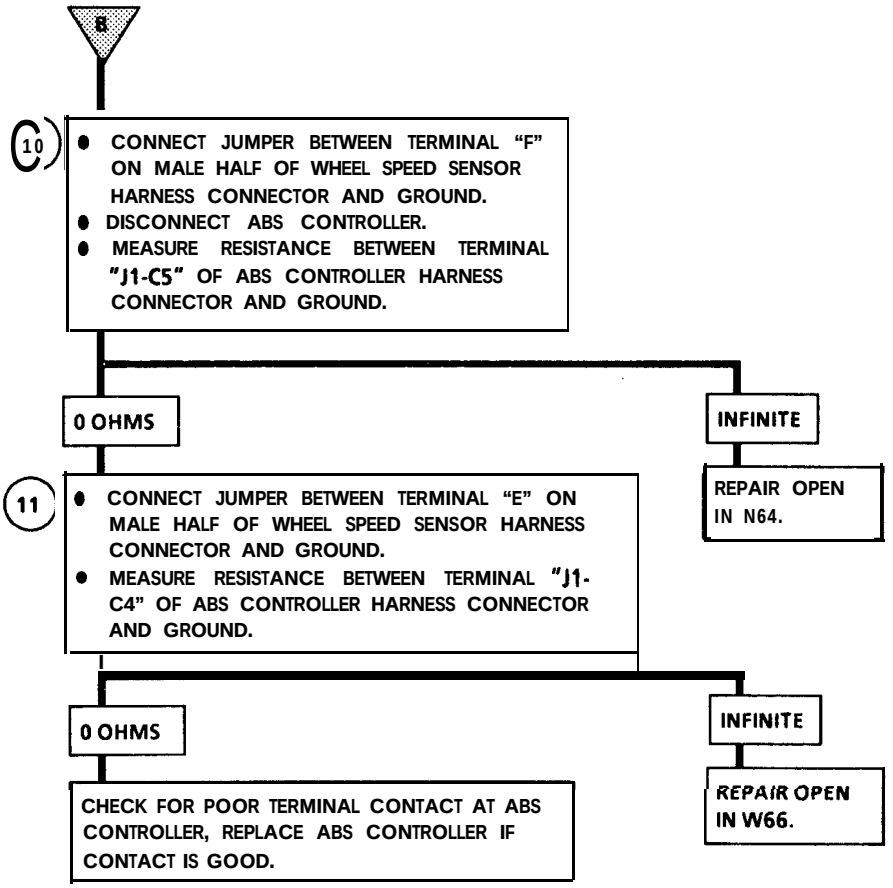
Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

10. With male of N64 connected to ground, the resistance from Terminal "J1-C5" to ground should be zero. If infinite resistance is measured, an open condition is indicated in N64.
11. With male of W66 connected to ground, the resistance from Terminal "Jl-C4" to ground should be zero. If infinite resistance is measured, an open condition is indicated in W66.

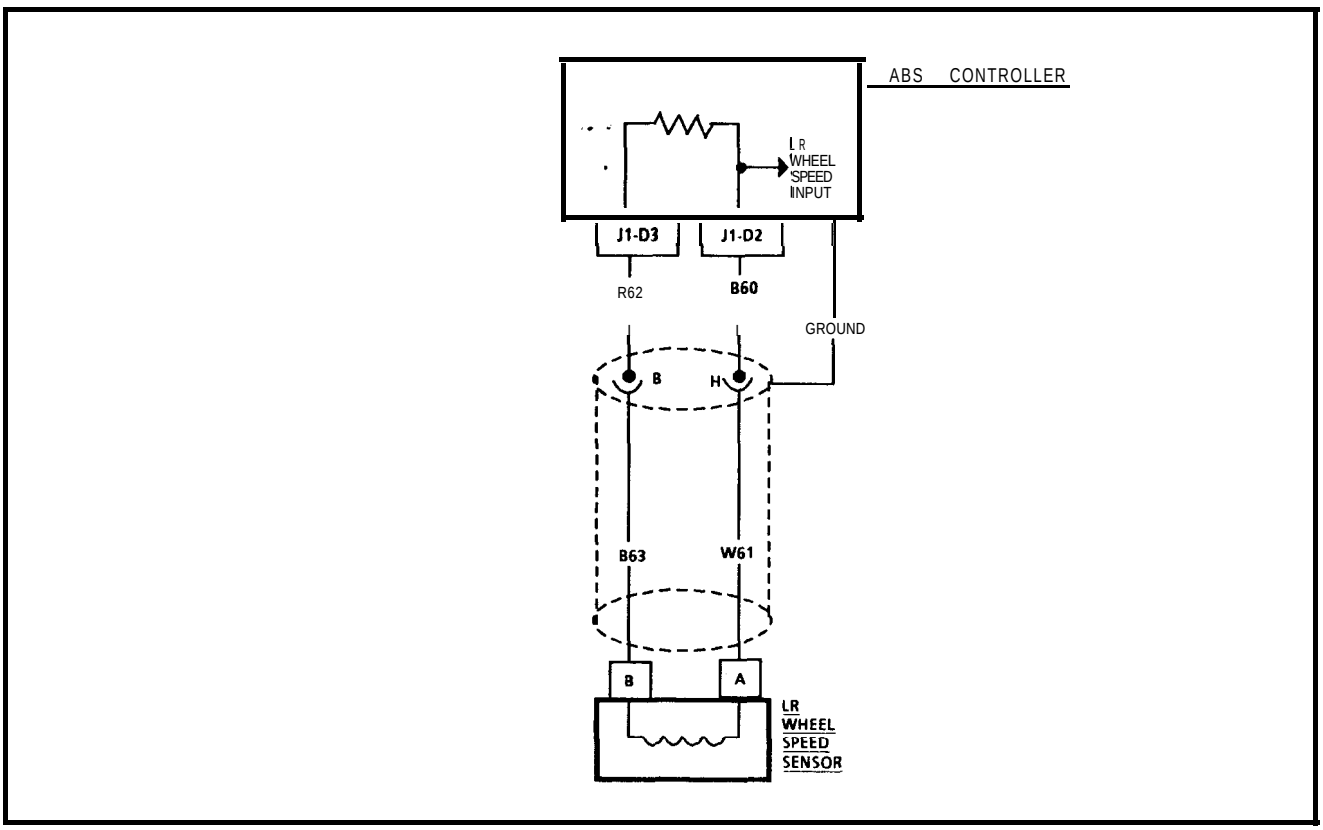
CODE A050

EXCESSIVE RIGHT REAR WHEEL ACCELERATION

CONTINUED FROM PAGE 141


B
10
• CONNECT JUMPER BETWEEN TERMINAL "F" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND.
• DISCONNECT ABS CONTROLLER.
• MEASURE RESISTANCE BETWEEN TERMINAL "J1-C5" OF ABS CONTROLLER HARNESS CONNECTOR AND GROUND.
0 OHMS
INFINITE
REPAIR OPEN IN N64.
11
• CONNECT JUMPER BETWEEN TERMINAL "E" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND.
• MEASURE RESISTANCE BETWEEN TERMINAL "J1-C4" OF ABS CONTROLLER HARNESS CONNECTOR AND GROUND.
0 OHMS
INFINITE
CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER, REPLACE ABS CONTROLLER IF CONTACT IS GOOD.
REPAIR OPEN IN W66.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A051

EXCESSIVE LEFT REAR WHEEL ACCELERATION

The ABS Controller uses the signal from the wheel speed sensor to detect if wheel speed lock-up is impending. If the frequency of the AC voltage produced by the wheel speed sensor indicates that the wheel is accelerating or decelerating faster than physically possible, the ABS Controller determines the signal is faulty and sets the code.

CODE A051 will set when all of the following conditions exist:

- The Brakes are not being applied (Brake Switch is off).
- The ABS Controller senses that the Left Rear Wheel has accelerated or decelerated greater than physically possible.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

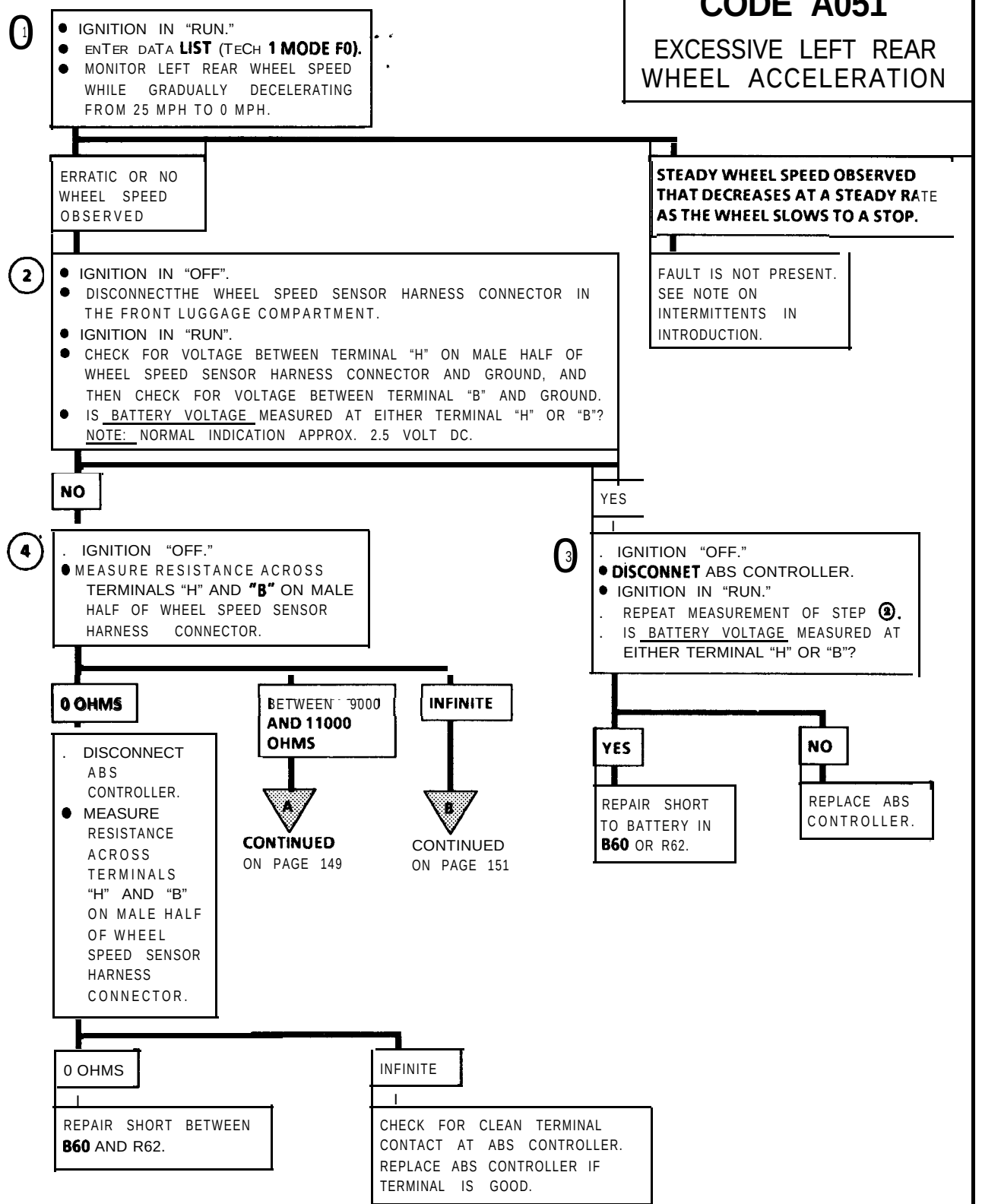
1. Observation of erratic or no wheel speed input indicates the fault is present and is not intermittent.

2.&3. Step 2 determines if a short to Battery is the fault. If Battery voltage is measured Step 3 isolates the short to the harness or controller.

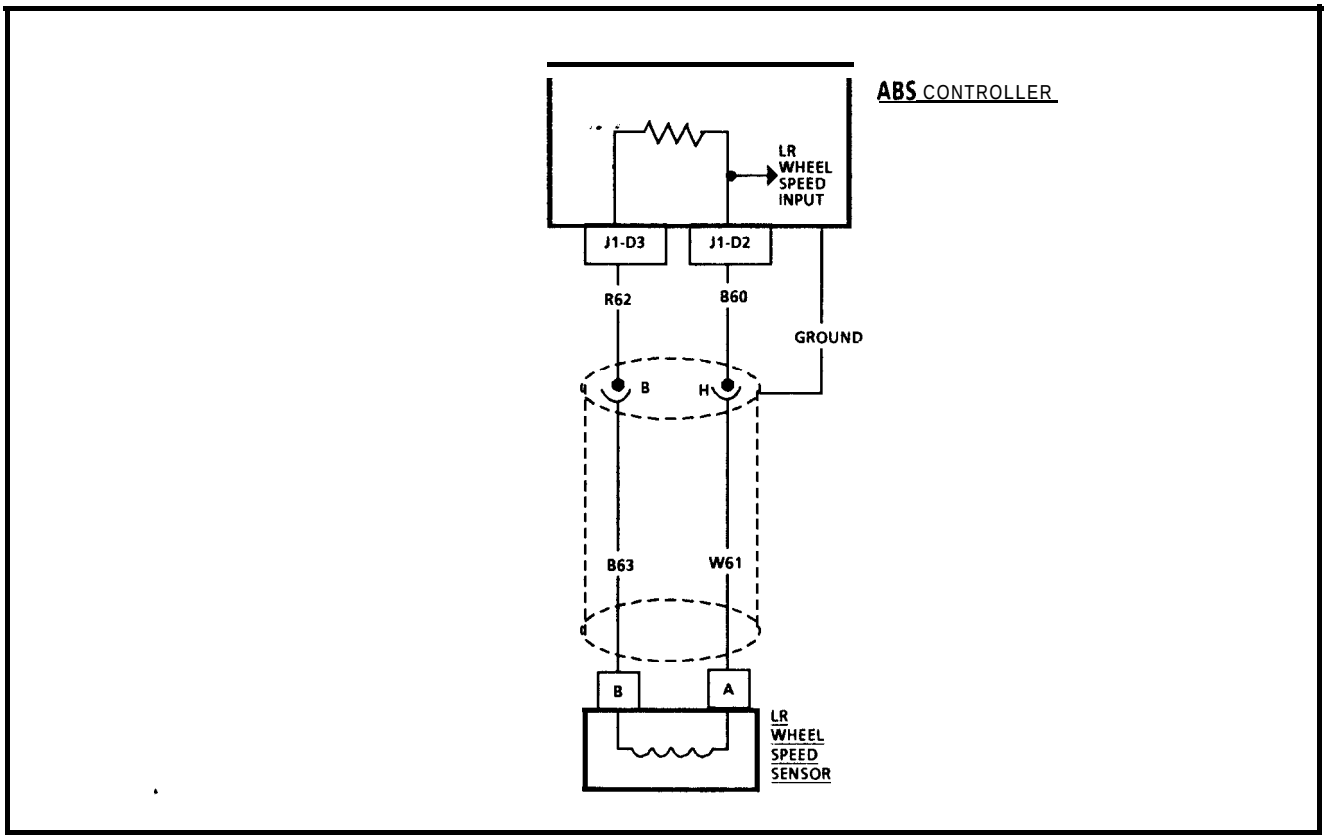
4. If 9000 to 11000 ohms were measured, the possibility of an open or short in the circuit between the ABS Controller and the male half of Wheel Speed Sensor Harness Connector has been eliminated.

CODE A051

EXCESSIVE LEFT REAR WHEEL ACCELERATION


1
• IGNITION IN "RUN."
• ENTER DATA LIST (TECH 1 MODE F0).
• MONITOR LEFT REAR WHEEL SPEED WHILE GRADUALLY DECELERATING FROM 25 MPH TO 0 MPH.
ERRATIC OR NO WHEEL SPEED OBSERVED
STEADY WHEEL SPEED OBSERVED THAT DECREASES AT A STEADY RATE AS THE WHEEL SLOWS TO A STOP.
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
2
• IGNITION IN "OFF".
• DISCONNECTTHE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT.
• IGNITION IN "RUN".
• CHECK FOR VOLTAGE BETWEEN TERMINAL "H" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND, AND THEN CHECK FOR VOLTAGE BETWEEN TERMINAL "B" AND GROUND.
• IS BATTERY VOLTAGE MEASURED AT EITHER TERMINAL "H" OR "B"?
NOTE: NORMAL INDICATION APPROX. 2.5 VOLT DC.
NO
YES
3
. IGNITION "OFF."
• DISCONNET ABS CONTROLLER.
• IGNITION IN "RUN."
. REPEAT MEASUREMENT OF STEP ②.
. IS BATTERY VOLTAGE MEASURED AT EITHER TERMINAL "H" OR "B"?
YES
REPAIR SHORT TO BATTERY IN B60 OR R62.
NO
REPLACE ABS CONTROLLER.
4
. IGNITION "OFF."
• MEASURE RESISTANCE ACROSS TERMINALS "H" AND "B" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.
0 OHMS
. DISCONNECT ABS CONTROLLER.
• MEASURE RESISTANCE ACROSS TERMINALS "H" AND "B" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.
0 OHMS
REPAIR SHORT BETWEEN B60 AND R62.
INFINITE
CHECK FOR CLEAN TERMINAL CONTACT AT ABS CONTROLLER. REPLACE ABS CONTROLLER IF TERMINAL IS GOOD.
BETWEEN 9000 AND 11000 OHMS
A
CONTINUED ON PAGE 149
INFINITE
B
CONTINUED ON PAGE 151

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A051

EXCESSIVE LEFT REAR WHEEL ACCELERATION

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

5. If more than 10 ohms is measured, the circuits between the ABS Controller and the male half of the Wheel Speed Sensor Harness Connector are OK. This isolates the fault to be between the Wheel Speed Sensor and the female half of the Wheel Speed Sensor Harness Connector. Since this area of the circuit is exposed to the elements and road debris, it should be carefully inspected for damage.
6. This procedure isolates the fault to a short to ground (998 to 1208 ohms) or open (above 1208 ohms) or a shorted sensor circuit (below 998 ohms).
7. & 8. Determines if the fault is in the harness or the Wheel Speed Sensor. If the harness between the Wheel Speed Sensor Harness Connector in the front luggage compartment and the Wheel Speed Sensor is defective, replace it. Do not attempt to repair it.

CODE A051
EXCESSIVE LEFT REAR WHEEL ACCELERATION

CONTINUED FROM PAGE 147

A

5. MEASURE RESISTANCE BETWEEN TERMINAL "H" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND, AND THEN MEASURE RESISTANCE BETWEEN TERMINAL "B" AND GROUND.
- WAS EITHER MEASURMENT LESS THAN 10 OHMS ?

NO

6. MEASURE RESISTANCE ACROSS TERMINALS "H" AND "B" ON FEMALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR.

ABOVE 1208 OHMS OR BELOW 998 OHMS

8. DISCONNECT LR WHEEL SPEED SENSOR.
- MEASURE RESISTANCE ACROSS WHEEL SPEED SENSOR.

ABOVE 1208 OHMS OR BELOW 998 OHMS

CLEAN WHEEL SPEED SENSOR TERMINALS OF ANY MOISTURE, CORROSION, DIRT, ETC. RECHECK RESISTANCE ACROSS WHEEL SPEED SENSOR. IF RESISTANCE STILL MEASURES ABOVE 1208 OHMS OR BELOW 998 OHMS, REPLACE LR WHEEL SPEED SENSOR.

BETWEEN 998 AND 1208 OHMS

7. DISCONNECT LR WHEEL SPEED SENSOR.
- MEASURE RESISTANCE BETWEEN TERMINAL "A" AT WHEEL SPEED SENSOR AND GROUND.

INFINITE

REPLACE HARNESS BETWEEN WHEEL SPEED SENSOR HARNESS CONNECTOR AND SPEED SENSOR.

1 MEGOHM OR LESS

REPLACE LR WHEEL SPEED SENSOR.

BETWEEN 998 AND 1208 OHMS

REPLACE HARNESS BETWEEN WHEEL SPEED SENSOR HARNESS CONNECTOR AND SPEED SENSOR.

YES

5. DISCONNECT ABS CONTROLLER.
- REPEAT MEASUREMENT OF STEP ⑤.
- WAS EITHER MEASUREMENT LESS THAN 10 OHMS ?

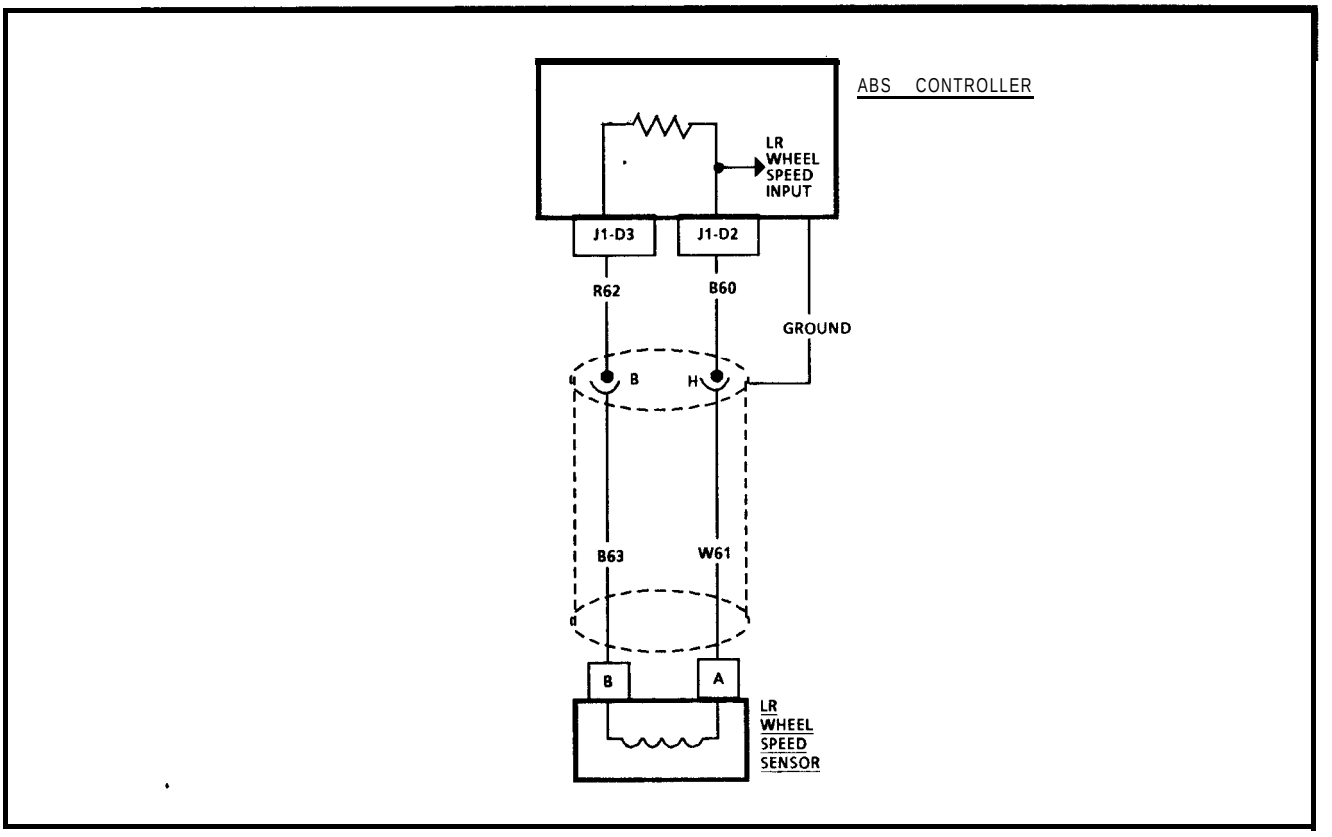
YES

REPAIR SHORT TO GROUND IN B60 OR R62.

NO

REPLACE ABS CONTROLLER.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A651

EXCESSIVE LEFT REAR WHEEL SPEED ACCELERATION

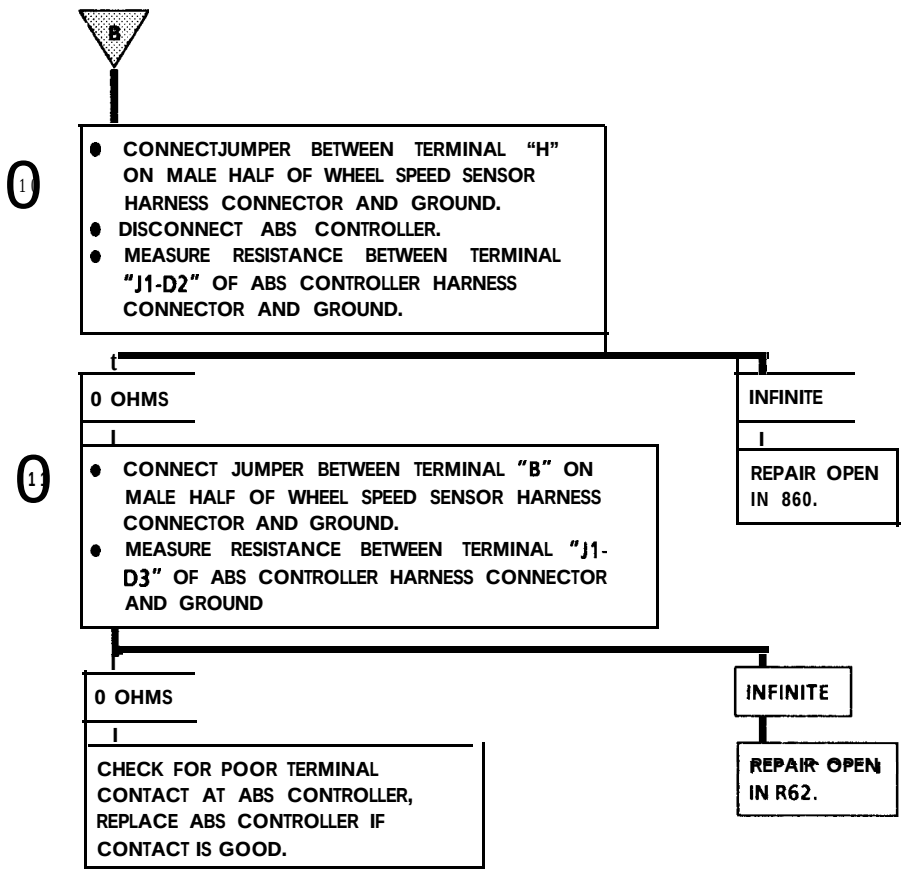
Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

10. With Male of B60 connected to ground, the resistance from Terminal "Jl-D2" to ground should be zero. If infinite resistance is measured, an open condition is indicated in B60.
11. With Male of R62 connected to ground, the resistance from Terminal "J1-D3" to ground should be zero. If infinite resistance is measured, an open condition is indicated in R62.

CODE A051

EXCESSIVE LEFT REAR WHEEL ACCELERATION

CONTINUED FROM PAGE 147


B
10
CONNECTJUMPER BETWEEN TERMINAL "H" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND.
DISCONNECT ABS CONTROLLER.
MEASURE RESISTANCE BETWEEN TERMINAL "J1-D2" OF ABS CONTROLLER HARNESS CONNECTOR AND GROUND.
0 OHMS
INFINITE
REPAIR OPEN IN 860.
11
CONNECT JUMPER BETWEEN TERMINAL "B" ON MALE HALF OF WHEEL SPEED SENSOR HARNESS CONNECTOR AND GROUND.
MEASURE RESISTANCE BETWEEN TERMINAL "J1-D3" OF ABS CONTROLLER HARNESS CONNECTOR AND GROUND
0 OHMS
INFINITE
CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER, REPLACE ABS CONTROLLER IF CONTACT IS GOOD.
REPAIR OPEN IN R62.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.

CODE A052

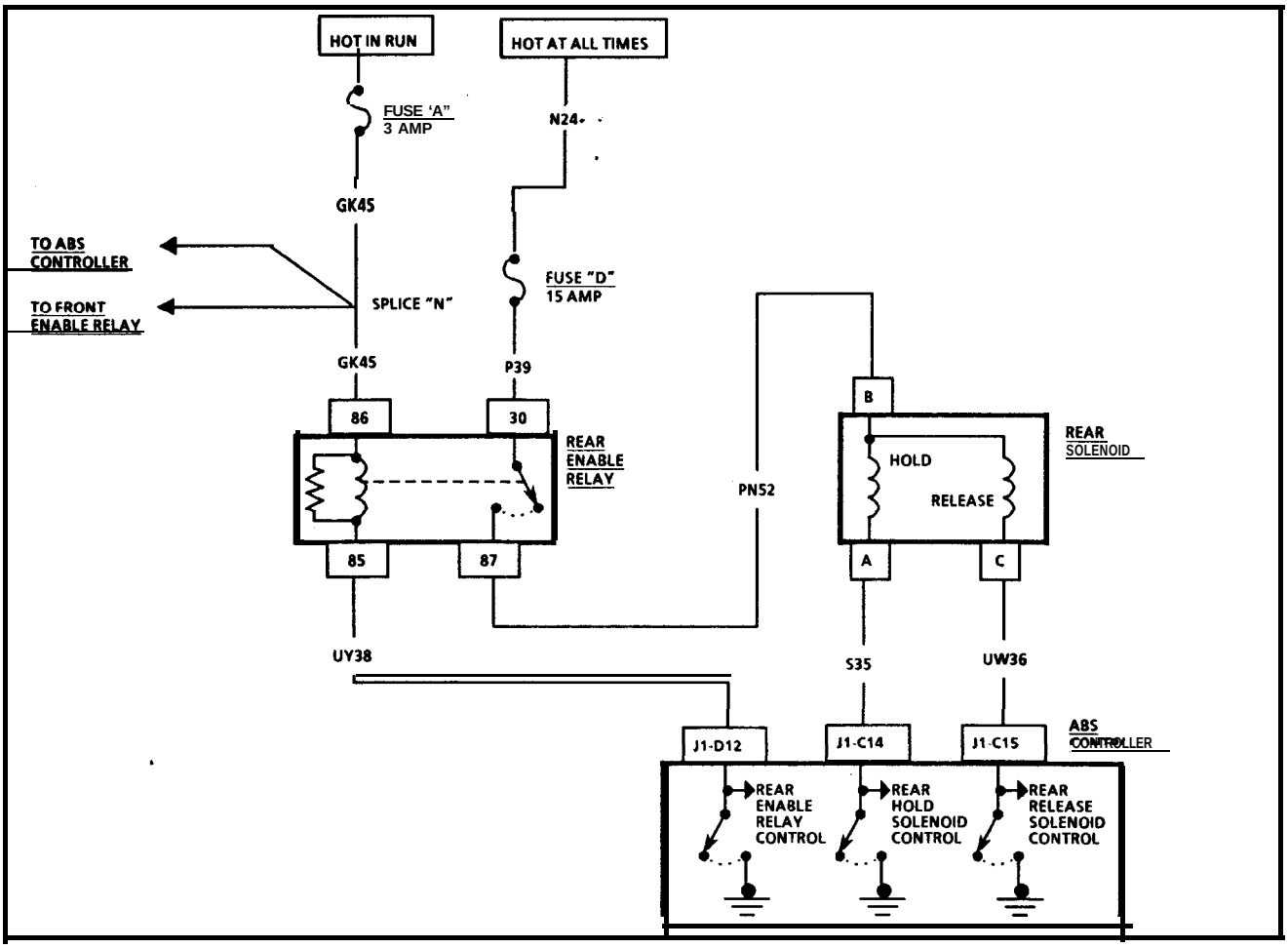
ABS CONTROLLER CALIBRATION ERROR

CODE A052 will set when the ABS Controller detects a malfunction internal to itself. If this code is set, replace the ABS Controller.

CODE A053

ABS CONTROLLER CALIBRATION ERROR

CODE A053 will set when the ABS Controller detects a malfunction internal to itself. If this code is set, replace the ABS Controller.



CODE A054

REAR ENABLE RELAY COIL CIRCUIT OPEN

When the ignition is in RUN, voltage is applied from the Fuse "A" to the Rear Enable Relay Coil. As long as the Rear Enable Relay Control is open, this voltage should also be present at Terminal "Jl-D12" of the Controller.

CODE A054 will set when all the following conditions exist:

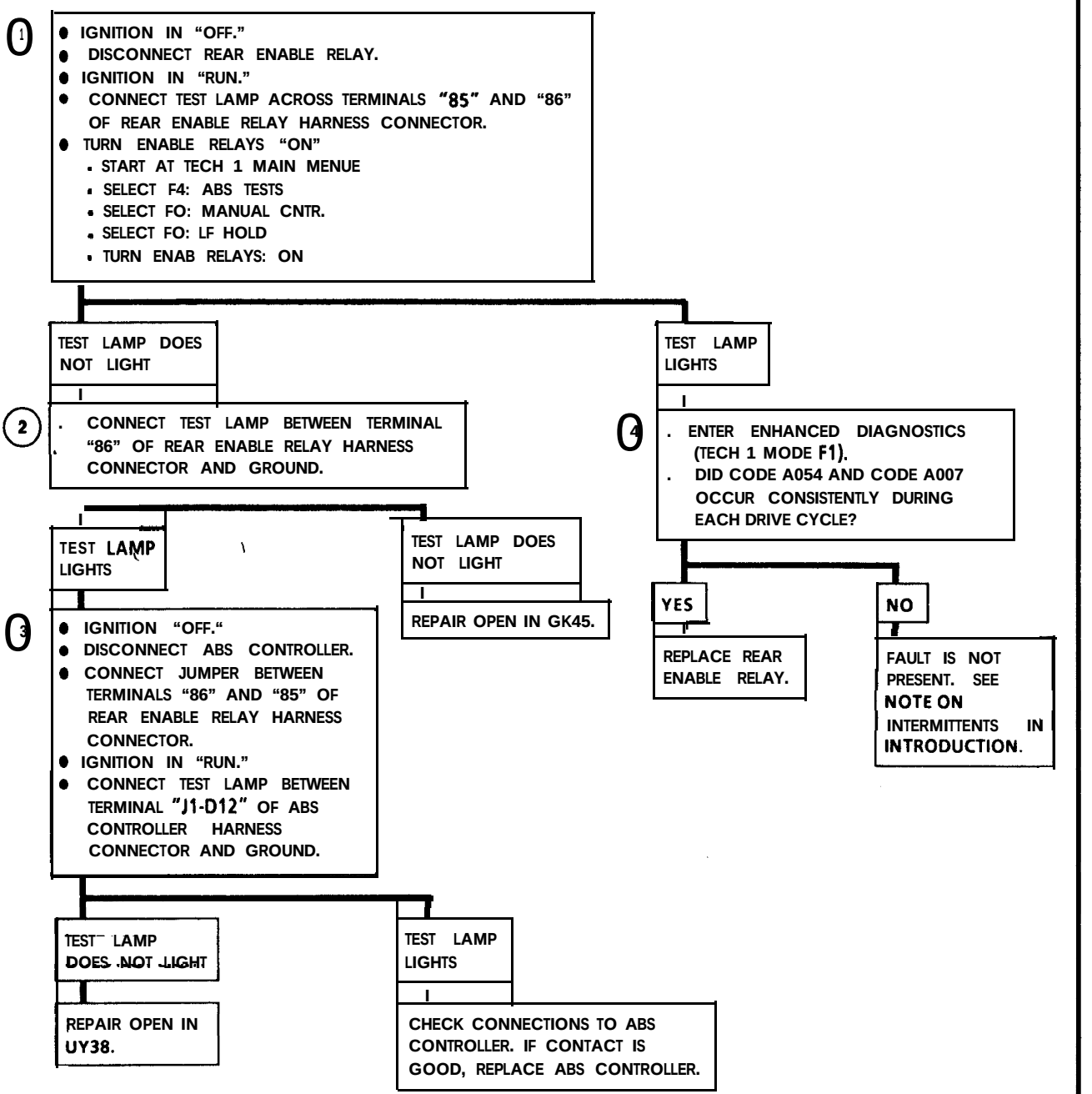
- The Rear Enable Relay Control is open (Rear Enable Relay deenergizedl.
- The ABS Controller senses no voltage at Terminal "Jl-D12".
- The ABS Controller senses no voltage at Terminals "J1-C14" and "Jl-C15".
- Codes A004 and A007 are current failures.

Test Description: The following provides an explanation of the procedures being followed in the trouble tree.

1. By monitoring the test lamp with the enable relays on, it can be determined if the power and ground circuits, as well as the Controller, are good.
2. If the test lamp does not light, the open must be in "GK45".
3. Voltage at Terminal "J1-D12" indicates a problem with the connection to the ABS Controller or the ABS Controller itself.
4. Determines if the Code was set due to a hard failure. At this point the hard failure must be in the Rear Enable Relay.

CODE A054

REAR ENABLE RELAY COIL CIRCUIT OPEN


1
• IGNITION IN "OFF."
• DISCONNECT REAR ENABLE RELAY.
• IGNITION IN "RUN."
• CONNECT TEST LAMP ACROSS TERMINALS "85" AND "86" OF REAR ENABLE RELAY HARNESS CONNECTOR.
• TURN ENABLE RELAYS "ON"
- START AT TECH 1 MAIN MENUE
- SELECT F4: ABS TESTS
- SELECT FO: MANUAL CNTR.
- SELECT FO: LF HOLD
- TURN ENAB RELAYS: ON
TEST LAMP DOES NOT LIGHT
TEST LAMP LIGHTS
2
. CONNECT TEST LAMP BETWEEN TERMINAL "86" OF REAR ENABLE RELAY HARNESS CONNECTOR AND GROUND.
TEST LAMP LIGHTS
TEST LAMP DOES NOT LIGHT
3
• IGNITION "OFF."
• DISCONNECT ABS CONTROLLER.
• CONNECT JUMPER BETWEEN TERMINALS "86" AND "85" OF REAR ENABLE RELAY HARNESS CONNECTOR.
• IGNITION IN "RUN."
• CONNECT TEST LAMP BETWEEN TERMINAL "J1-D12" OF ABS CONTROLLER HARNESS CONNECTOR AND GROUND.
REPAIR OPEN IN GK45.
TEST LAMP DOES NOT LIGHT
TEST LAMP LIGHTS
REPAIR OPEN IN UY38.
CHECK CONNECTIONS TO ABS CONTROLLER. IF CONTACT IS GOOD, REPLACE ABS CONTROLLER.
4
. ENTER ENHANCED DIAGNOSTICS (TECH 1 MODE F1).
. DID CODE A054 AND CODE A007 OCCUR CONSISTENTLY DURING EACH DRIVE CYCLE?
YES
NO
REPLACE REAR ENABLE RELAY.
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.

CODE A055

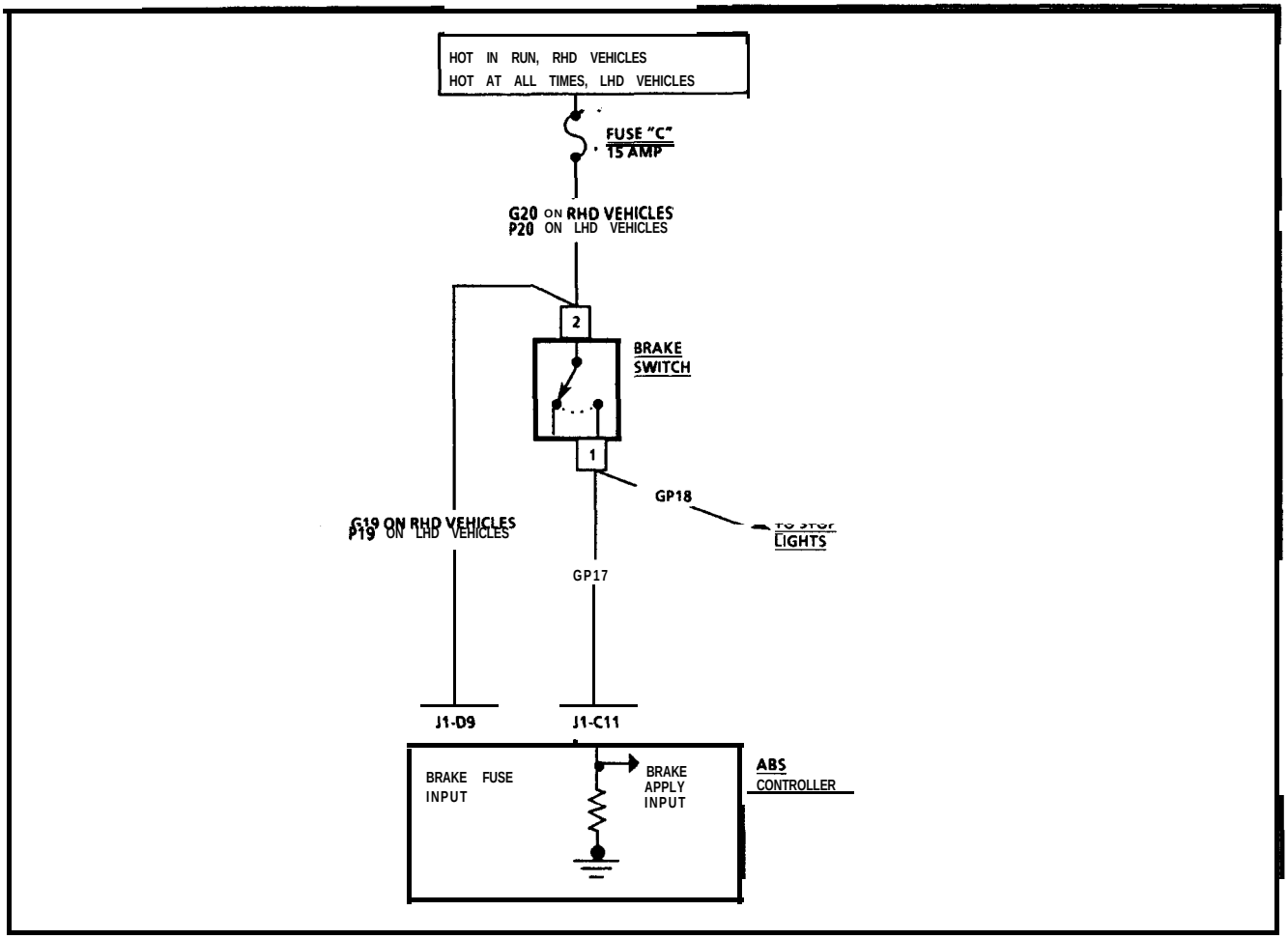
ABS CONTROLLER INTERNAL VOLTAGE FAULT

CODE A055 will set when the ABS Controller detects a malfunction internal to itself. If this code is set, replace the ABS Controller.

CODE A056

TEST 32 OR 33 FAILED LAST OR CURRENT IGNITION CYCLE

CODE A056 is the same as CODE A032. For further information. see page 80 .



CODE A057

BRAKE SWITCH FUSE INPUT IS LOW (GROUND)

Voltage is applied through Fuse "C" to the Brake Switch and terminal "J1-D9" of the ABS-Controller. Code A057 will set when the following condition exists:

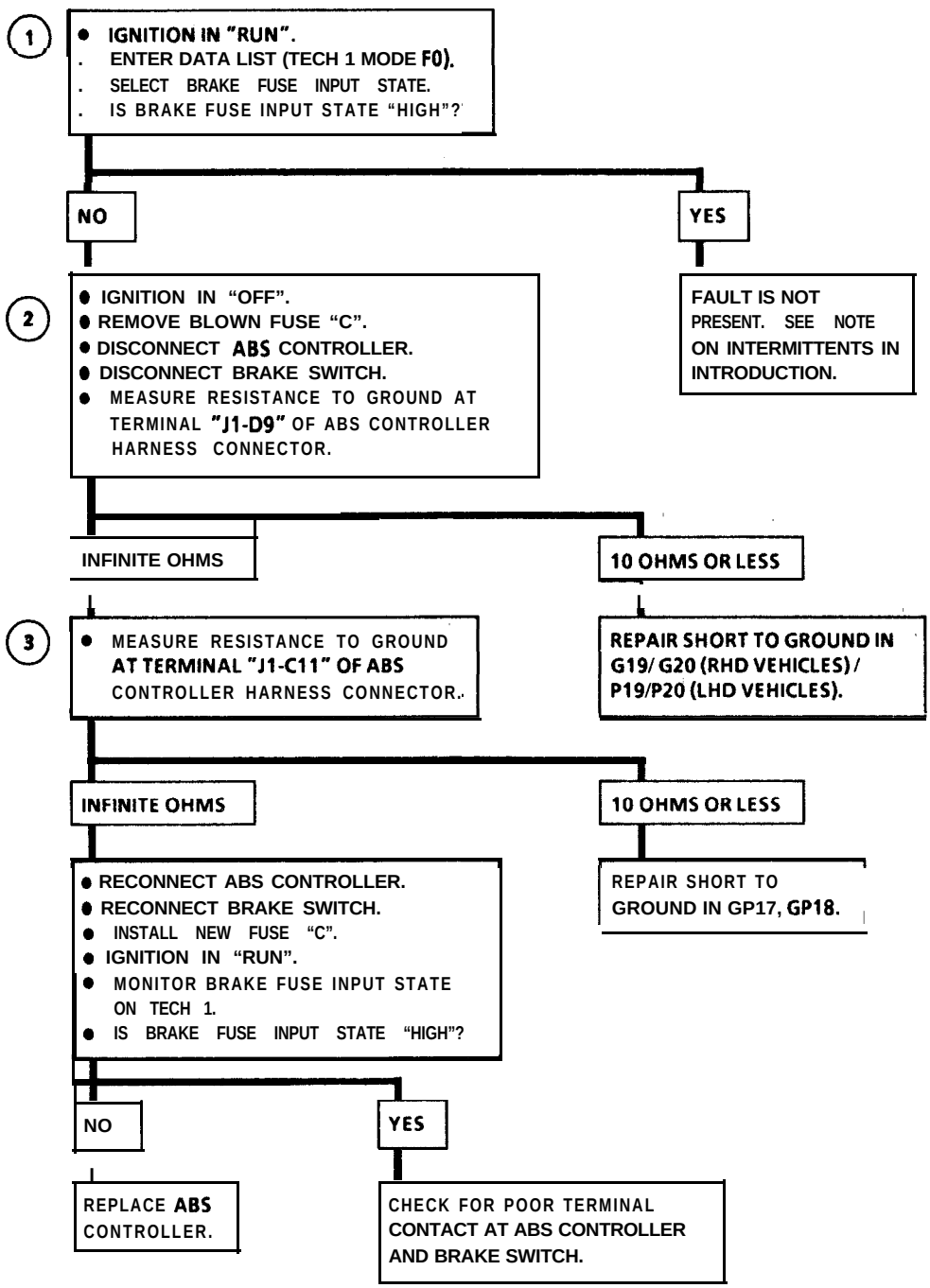
- Brake Switch Fuse Input is low (ground).

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

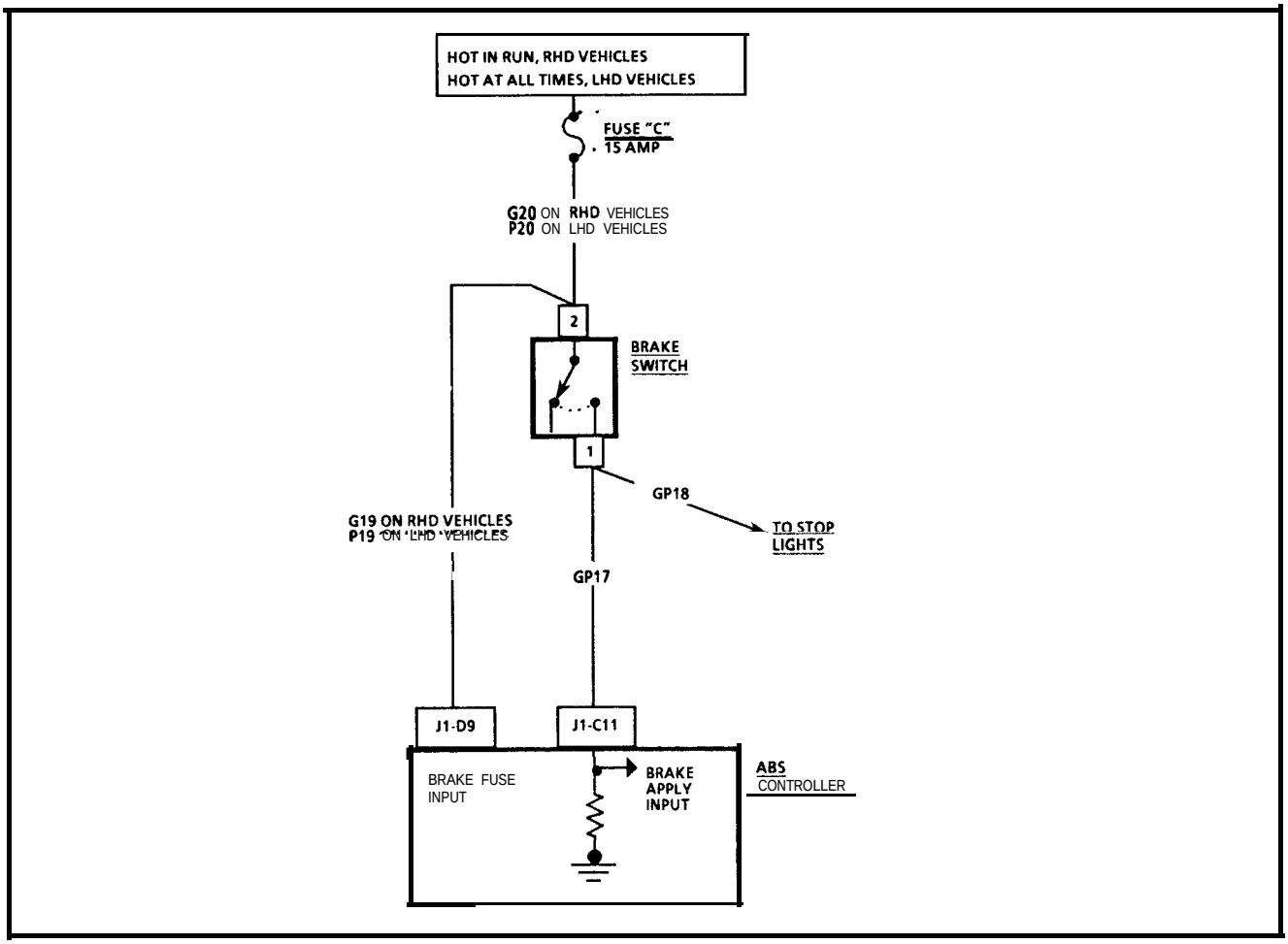
1. Confirms that a problem exists in the Brake Fuse Input CKT.
2. Determines if the short to grround is in G19/G20 (RHD VEHICLES) / P19/P20 (LHD VEHICLES)
3. Determines if the short to ground is in GP17, GP18.

CODE A057

BRAKE SWITCH FUSE INPUT IS LOW (GROUND)


1
• IGNITION IN "RUN".
. ENTER DATA LIST (TECH 1 MODE F0).
. SELECT BRAKE FUSE INPUT STATE.
. IS BRAKE FUSE INPUT STATE "HIGH"?
NO
YES
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
2
• IGNITION IN "OFF".
• REMOVE BLOWN FUSE "C".
• DISCONNECT ABS CONTROLLER.
• DISCONNECT BRAKE SWITCH.
• MEASURE RESISTANCE TO GROUND AT TERMINAL "J1-D9" OF ABS CONTROLLER HARNESS CONNECTOR.
INFINITE OHMS
10 OHMS OR LESS
3
• MEASURE RESISTANCE TO GROUND AT TERMINAL "J1-C11" OF ABS CONTROLLER HARNESS CONNECTOR.
REPAIR SHORT TO GROUND IN G19/G20 (RHD VEHICLES)/ P19/P20 (LHD VEHICLES).
INFINITE OHMS
10 OHMS OR LESS
• RECONNECT ABS CONTROLLER.
• RECONNECT BRAKE SWITCH.
• INSTALL NEW FUSE "C".
• IGNITION IN "RUN".
• MONITOR BRAKE FUSE INPUT STATE ON TECH 1.
• IS BRAKE FUSE INPUT STATE "HIGH"?
REPAIR SHORT TO GROUND IN GP17, GP18.
NO
YES
REPLACE ABS CONTROLLER.
CHECK FOR POOR TERMINAL CONTACT AT ABS CONTROLLER AND BRAKE SWITCH.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A058

BRAKE LIGHTS OPEN, GROUND OPEN

The ABS Controller determines that the Brake Pedal is pressed when battery voltage is sensed at the Brake Apply Input. If battery voltage is not present, the Controller should sense ground through "J1-C11, GP17, GP18" and the Stop Lights.

CODE A058 will set when all the following conditions exist:

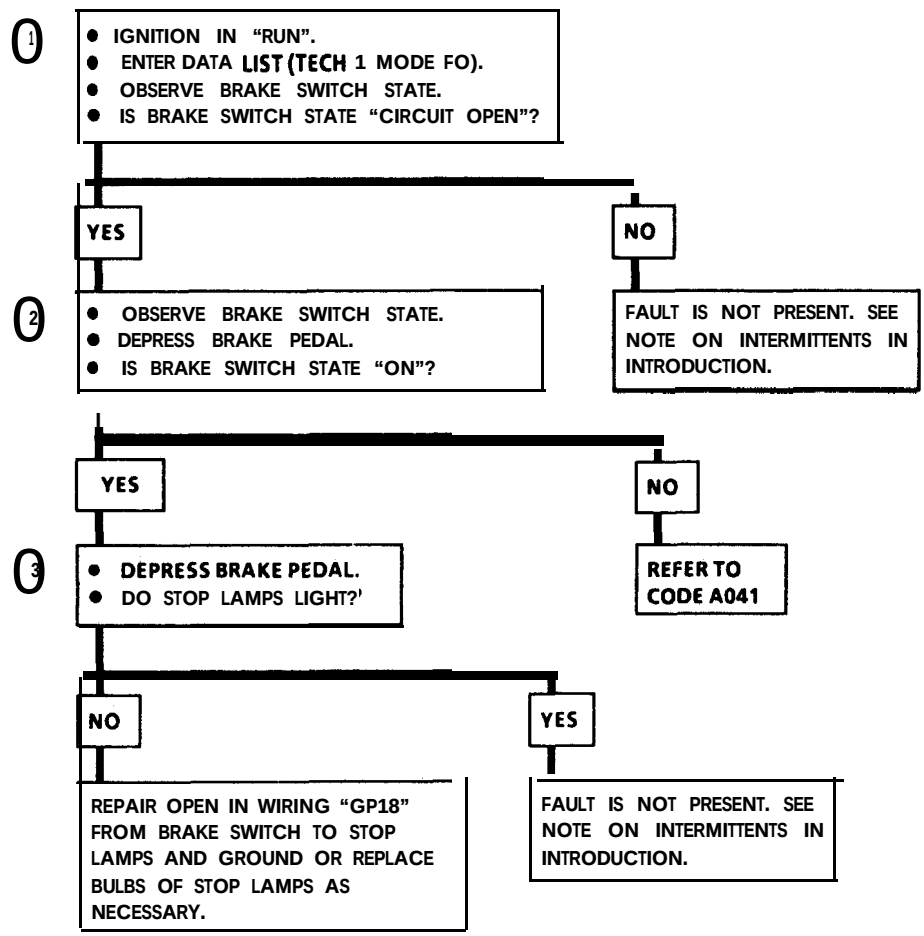
- Test 41 is failing.
- Brake Switch Fuse Input is high
- Brake Switch Circuit Input is high.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

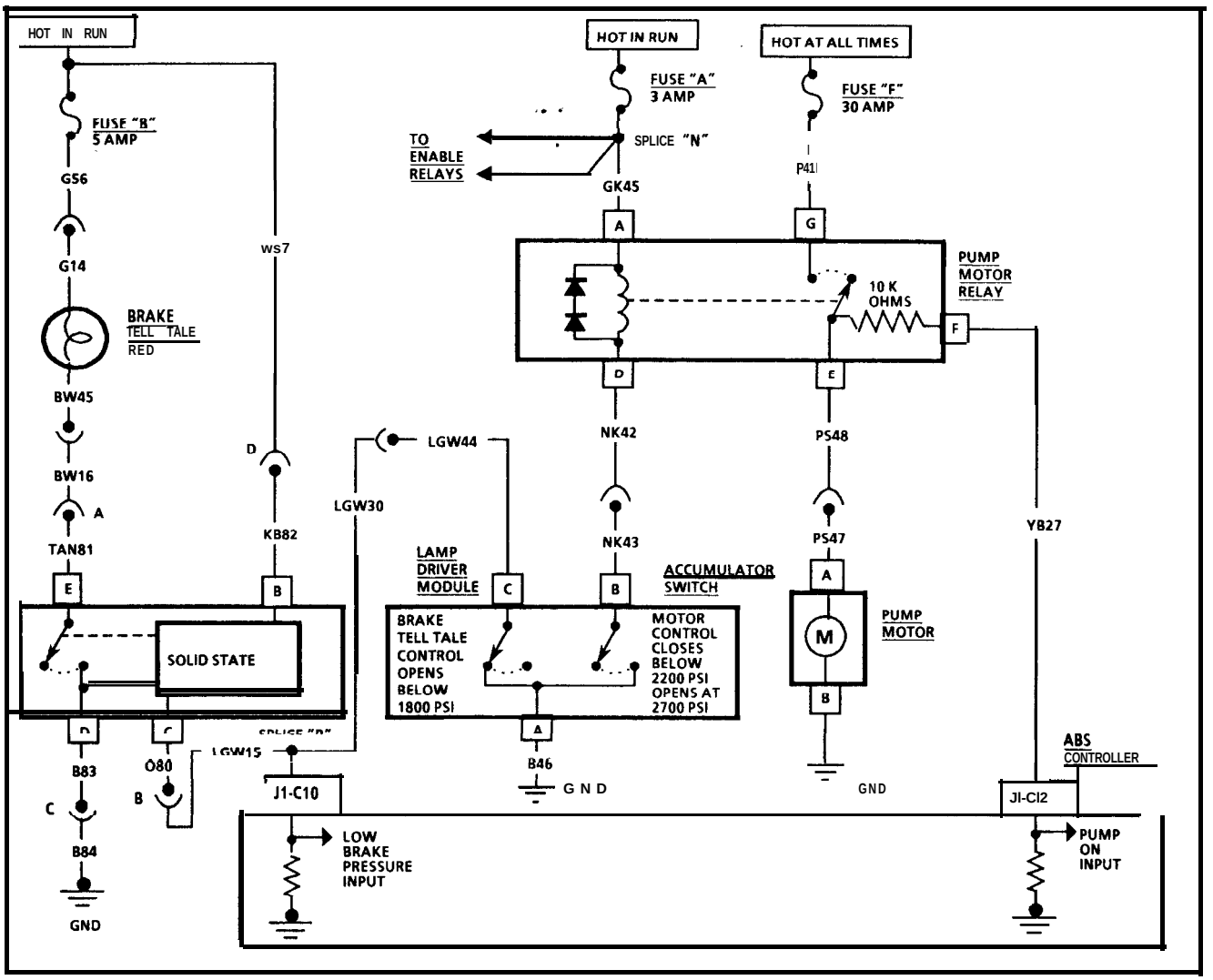
1. By observing the Brake Switch State it can be determined if the ABS Controller is sensing the proper input (a proper input at this point would indicate an intermittent fault condition).
2. Determines if the open condition exists in GP18 between the Brake Switch and the Stop Lights or if the open condition exists in GP17 between the Brake Switch and the ABS Controller "J1-C11" (Code A041).
3. Determines if the fault is an intermittent failure or if an open condition exsists in the wiring from the Brake Switch through the Stop Lamps to ground.

CODE A058

BRAKE LIGHTS OPEN, GROUND OPEN


1
IGNITION IN "RUN".
ENTER DATA LIST (TECH 1 MODE FO).
OBSERVE BRAKE SWITCH STATE.
IS BRAKE SWITCH STATE "CIRCUIT OPEN"?
YES
NO
2
OBSERVE BRAKE SWITCH STATE.
DEPRESS BRAKE PEDAL.
IS BRAKE SWITCH STATE "ON"?
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
YES
NO
3
DEPRESS BRAKE PEDAL.
DO STOP LAMPS LIGHT?'
REFER TO CODE A041
NO
YES
REPAIR OPEN IN WIRING "GP18" FROM BRAKE SWITCH TO STOP LAMPS AND GROUND OR REPLACE BULBS OF STOP LAMPS AS NECESSARY.
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A059

LOW BRAKE PRESSURE WHILE IN AN ABS STOP

CODE A059 will set when all of the following conditions exist

- The car is in an Antilock Brake stop.
- The Pump On Input senses voltage (pump running).
- The ABS Controller senses voltage at the Low Brake Pressure Input for greater than 10 seconds during and after the Antilock Brake stop.

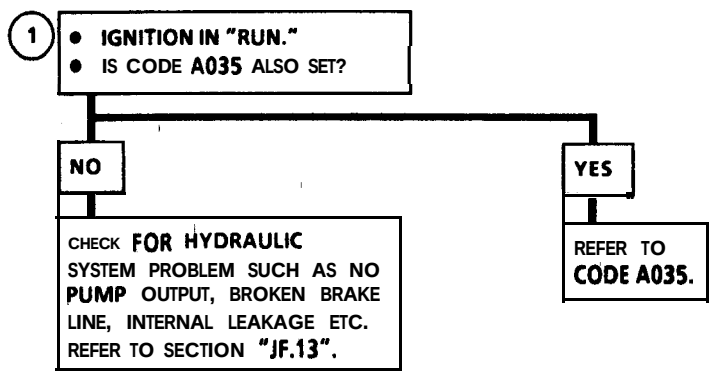
Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. If Code A035 is also set, the fault is due to an electrical problem which can be diagnosed by referring to Code A035.

If Code A059 has not set along with any other codes, a hydraulic system fault is indicated and can be diagnosed by referring to Section "JF. 13". Possible causes are no pump output, broken brake line, internal leakage, etc.

CODE A059

LOW BRAKE PRESSURE WHILE IN AN ABS STOP

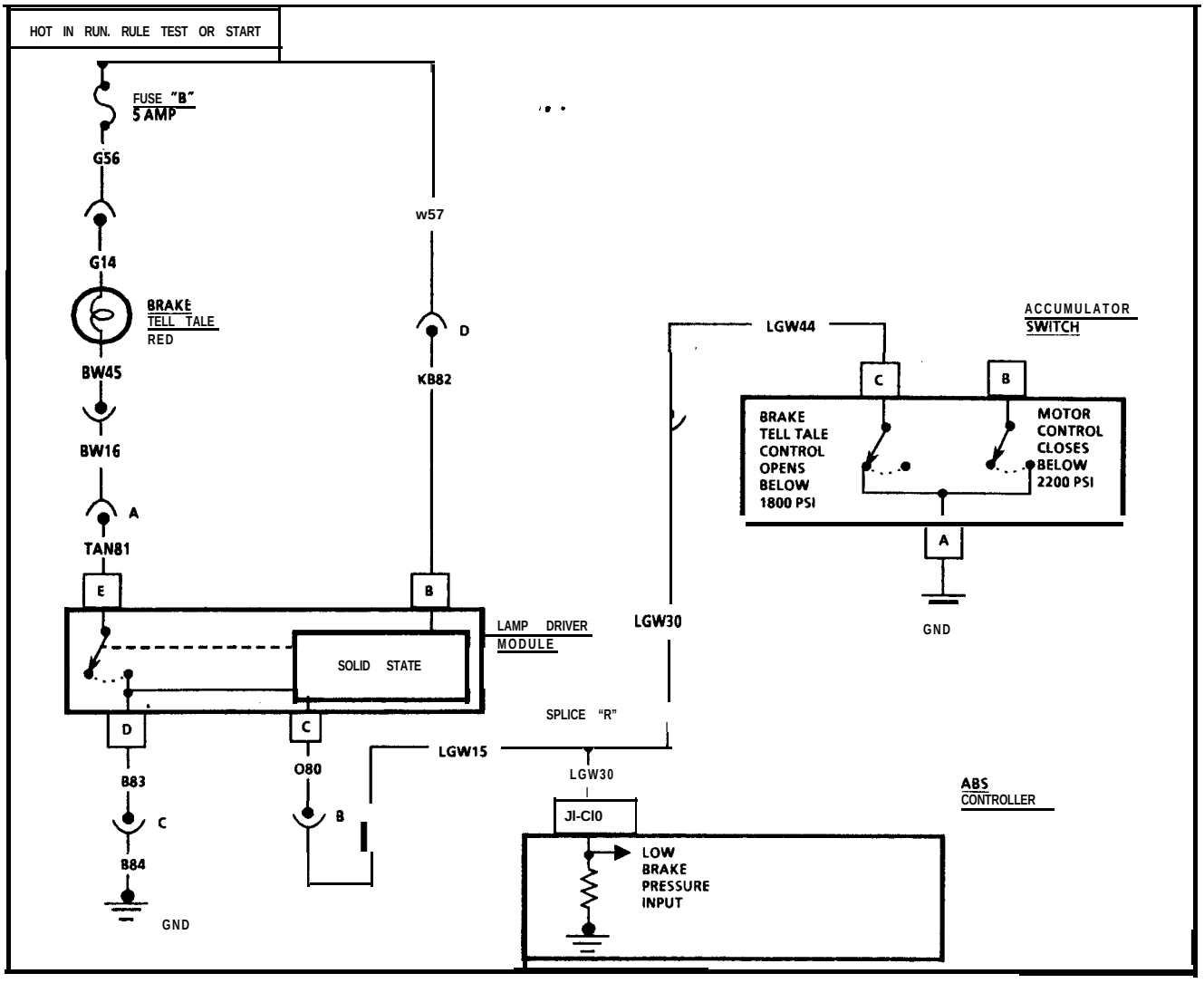

1
• IGNITION IN "RUN."
• IS CODE A035 ALSO SET?
NO
YES
CHECK FOR HYDRAULIC SYSTEM PROBLEM SUCH AS NO PUMP OUTPUT, BROKEN BRAKE LINE, INTERNAL LEAKAGE ETC. REFER TO SECTION "JF.13".
REFER TO CODE A035.

AN EXPLANATION OF EACH TEST PROCEDURE REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.

CODE A060

ABS CONTROLLER INTERNAL FAULT

CODE **A060 will set when the ABS Controller detects a malfunction internal to itself. If this code is set, replace the ABS Controller.**



CODE A061

SYSTEM WILL NOT BUILD PRESSURE

The Acummulator Pressure Switch Motor Control closes when the pressure drops below 2200 PSI. This grounds the Pump Motor Relay Coil causing voltage to be applied to the Pump Motor and Pump On Input, Whenever the Pump Motor is on, the Pump On Input will have voltage applied to it.

CODE A061 will set when all of the following conditions exist:

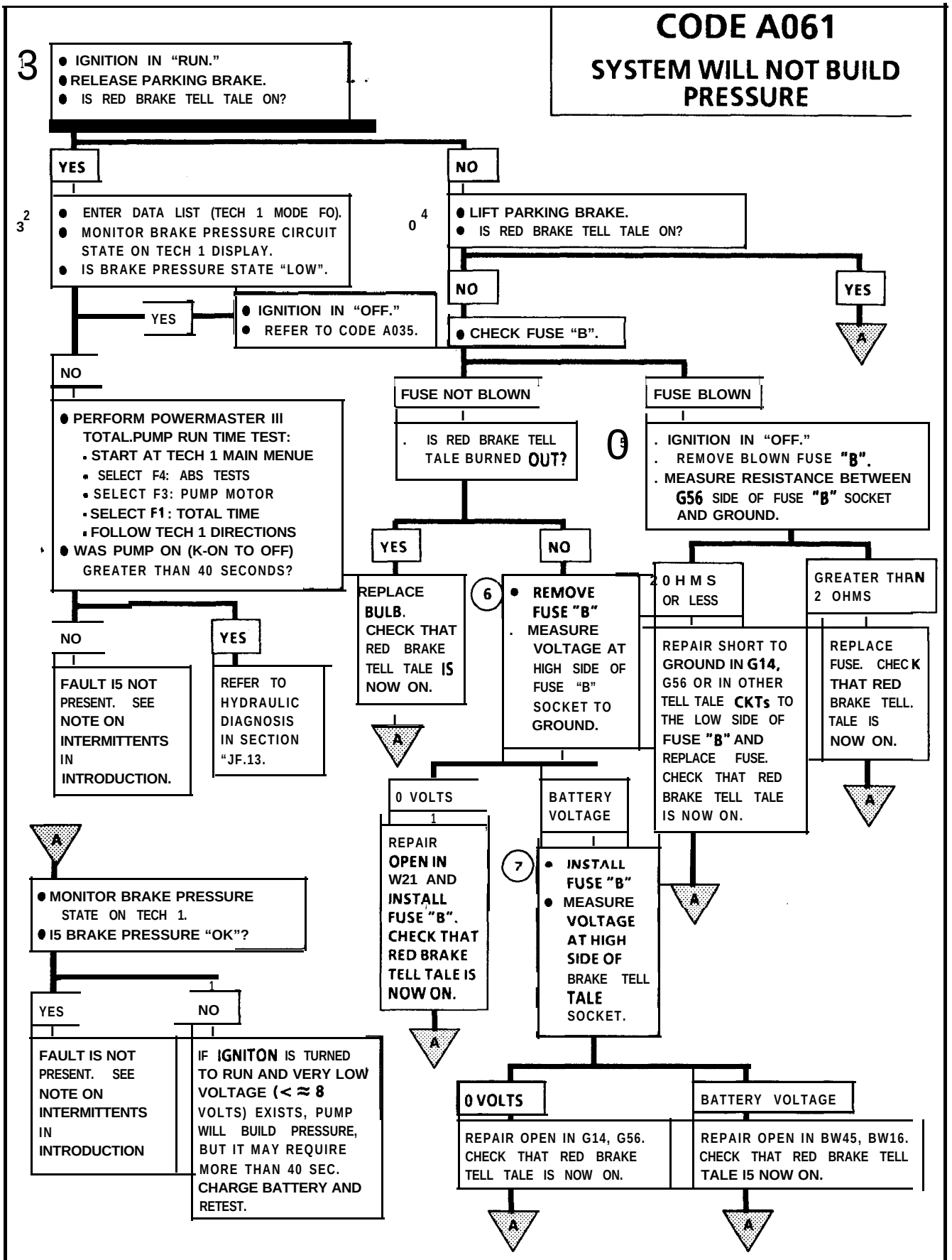
- Low pressure present when the ignition key is turned to "RUN".
- Low pressure present for 40 seconds.
- No more than 3 brake pedal actuations

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

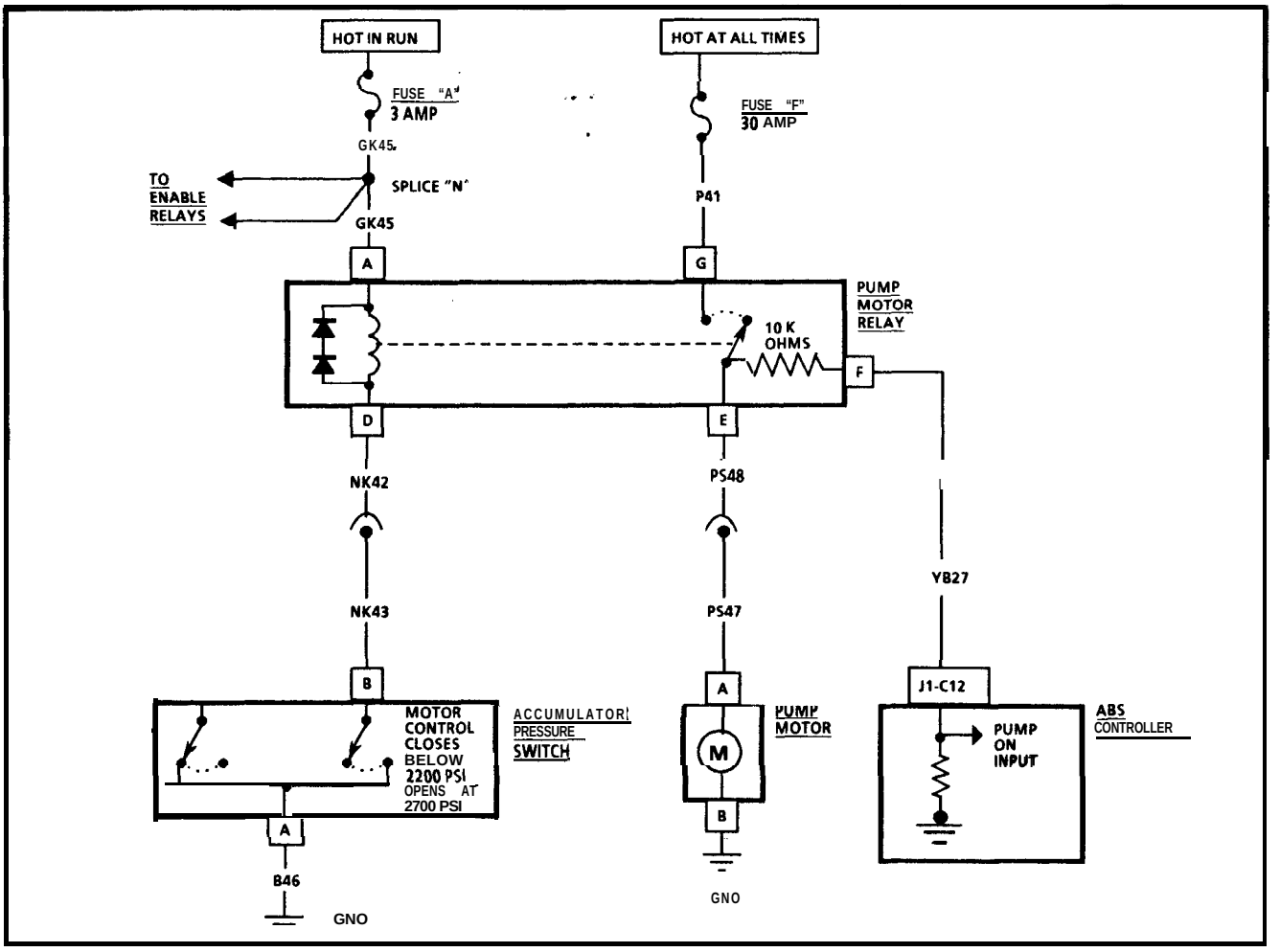
1. If the red Brake Tell Tale is not on, an open or short condition exists in the Lamp circuit.
2. If Brake Pressure State is low, the fault is due to an electrical problem which can be diagnosed by referring to Code A035.
3. The Powermaster III Test checks the hydraulic part of ABS.
4. If red Brake Tell Tale is not on, an open or short condition exists in the Lamp circuit.
5. Determines if a short to ground exists in G14, G56 or in other Tell Tale circuits to the low side of Fuse "B".
6. Determines if an open condition exists in W21.
7. Determines if the open condition exists in G14, G56 or BW45. BW16.

CODE A061

SYSTEM WILL NOT BUILD PRESSURE


3
• IGNITION IN "RUN."
• RELEASE PARKING BRAKE.
• IS RED BRAKE TELL TALE ON?
YES
NO
2
• ENTER DATA LIST (TECH 1 MODE FO).
• MONITOR BRAKE PRESSURE CIRCUIT STATE ON TECH 1 DISPLAY.
• IS BRAKE PRESSURE STATE "LOW".
YES
• IGNITION IN "OFF."
• REFER TO CODE A035.
NO
• PERFORM POWERMASTER III TOTAL.PUMP RUN TIME TEST:
▪ START AT TECH 1 MAIN MENUE
▪ SELECT F4: ABS TESTS
▪ SELECT F3: PUMP MOTOR
▪ SELECT F1: TOTAL TIME
▪ FOLLOW TECH 1 DIRECTIONS
• WAS PUMP ON (K-ON TO OFF) GREATER THAN 40 SECONDS?
NO
FAULT I5 NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
YES
REFER TO HYDRAULIC DIAGNOSIS IN SECTION "JF.13.
4
• LIFT PARKING BRAKE.
• IS RED BRAKE TELL TALE ON?
NO
YES
A
• CHECK FUSE "B".
FUSE NOT BLOWN
. IS RED BRAKE TELL TALE BURNED OUT?
YES
REPLACE BULB. CHECK THAT RED BRAKE TELL TALE IS NOW ON.
A
NO
6
• REMOVE FUSE "B"
. MEASURE VOLTAGE AT HIGH SIDE OF FUSE "B" SOCKET TO GROUND.
0 VOLTS
REPAIR OPEN IN W21 AND INSTALL FUSE "B". CHECK THAT RED BRAKE TELL TALE IS NOW ON.
A
BATTERY VOLTAGE
7
• INSTALL FUSE "B"
• MEASURE VOLTAGE AT HIGH SIDE OF BRAKE TELL TALE SOCKET.
0 VOLTS
REPAIR OPEN IN G14, G56. CHECK THAT RED BRAKE TELL TALE IS NOW ON.
A
BATTERY VOLTAGE
REPAIR OPEN IN BW45, BW16. CHECK THAT RED BRAKE TELL TALE I5 NOW ON.
A
FUSE BLOWN
5
. IGNITION IN "OFF."
. REMOVE BLOWN FUSE "B".
. MEASURE RESISTANCE BETWEEN G56 SIDE OF FUSE "B" SOCKET AND GROUND.
2 OHMS OR LESS
REPAIR SHORT TO GROUND IN G14, G56 OR IN OTHER TELL TALE CKTs TO THE LOW SIDE OF FUSE "B" AND REPLACE FUSE. CHECK THAT RED BRAKE TELL TALE IS NOW ON.
A
GREATER THAN 2 OHMS
REPLACE FUSE. CHECK THAT RED BRAKE TELL. TALE IS NOW ON.
A
A
• MONITOR BRAKE PRESSURE STATE ON TECH 1.
• I5 BRAKE PRESSURE "OK"?
YES
FAULT IS NOT PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION
NO
IF IGNITON IS TURNED TO RUN AND VERY LOW VOLTAGE (< ≈ 8 VOLTS) EXISTS, PUMP WILL BUILD PRESSURE, BUT IT MAY REQUIRE MORE THAN 40 SEC. CHARGE BATTERY AND RETEST.

AN EXPLANATION OF EACH TEST PROCEDURE REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE.
WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A062

LOW ACCUMULATOR PRE-CHARGE

The Accumulator is precharged to approximately 1200 PSI with nitrogen gas. The Pump Motor maintains system pressure between 2200 PSI and approximately 2700 PSI. The Accumulator Switch Motor Control closes when the pressure drops below 2200 PSI. This grounds the Pump Motor Relay Coil causing voltage to be applied to the Pump Motor and Pump On Input. Whenever the Pump Motor is on, the Pump On Input will have voltage applied to it. The Pump Motor will run until system pressure is restored to approximately 2700 PSI.

CODE A062 will set when the ABS Controller detects short pump run times of less than 1.4 seconds in duration.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. If the pump run time from "OK pressure" to "pump off time" is less than six seconds a low accumulator precharge or poor accumulator switch point condition is indicated. Section "JF.13" contains tests with a pressure gage which will isolate the problem further.
2. If normal pump run cycle is less than 1.7 seconds, a miscalibrated accumulator switch or low accumulator precharge is indicated. Section "JF.13" contains tests with a pressure gage to check switch calibrations.

CODE A062

LOW ACCUMULATOR PRECHARGE

- IGNITION IN "RUN."
- IS CODE A031 ALSO SET?

NO

(1) PERFORM POWERMASTER III TOTAL PUMP RUN TIME TEST:
- START AT TECH 1 MAIN MENUE
- SELECT F4: ABS TESTS
- SELECT F3: PUMP MOTOR
- SELECT F1 : TOTAL TIME
- FOLLOW TECH 1 DIRECTIONS

- MONITOR PUMP MOTOR TIME FROM "OK PRESS" TO "OFF".
- WAS PUMP ON GREATER THAN 6 SECONDS?

YES

REFER TO CODE A031 FOR DIAGNOSIS.

NO

(2) PERFORM NORMAL PUMP RUN CYCLE TEST:
- START AT TECH 1 MAIN MENUE
- SELECT F4: ABS TESTS
- SELECT F3: PUMP MOTOR
- SELECT FO: RUN CYCLE
- FOLLOW TECH 1 DIRECTIONS

- IS ONE PUMP RUN TIME LESS THAN 1.7 SECONDS?

YES

REFER TO HYDRAULIC DIAGNOSIS IN SECTION "JF.13".

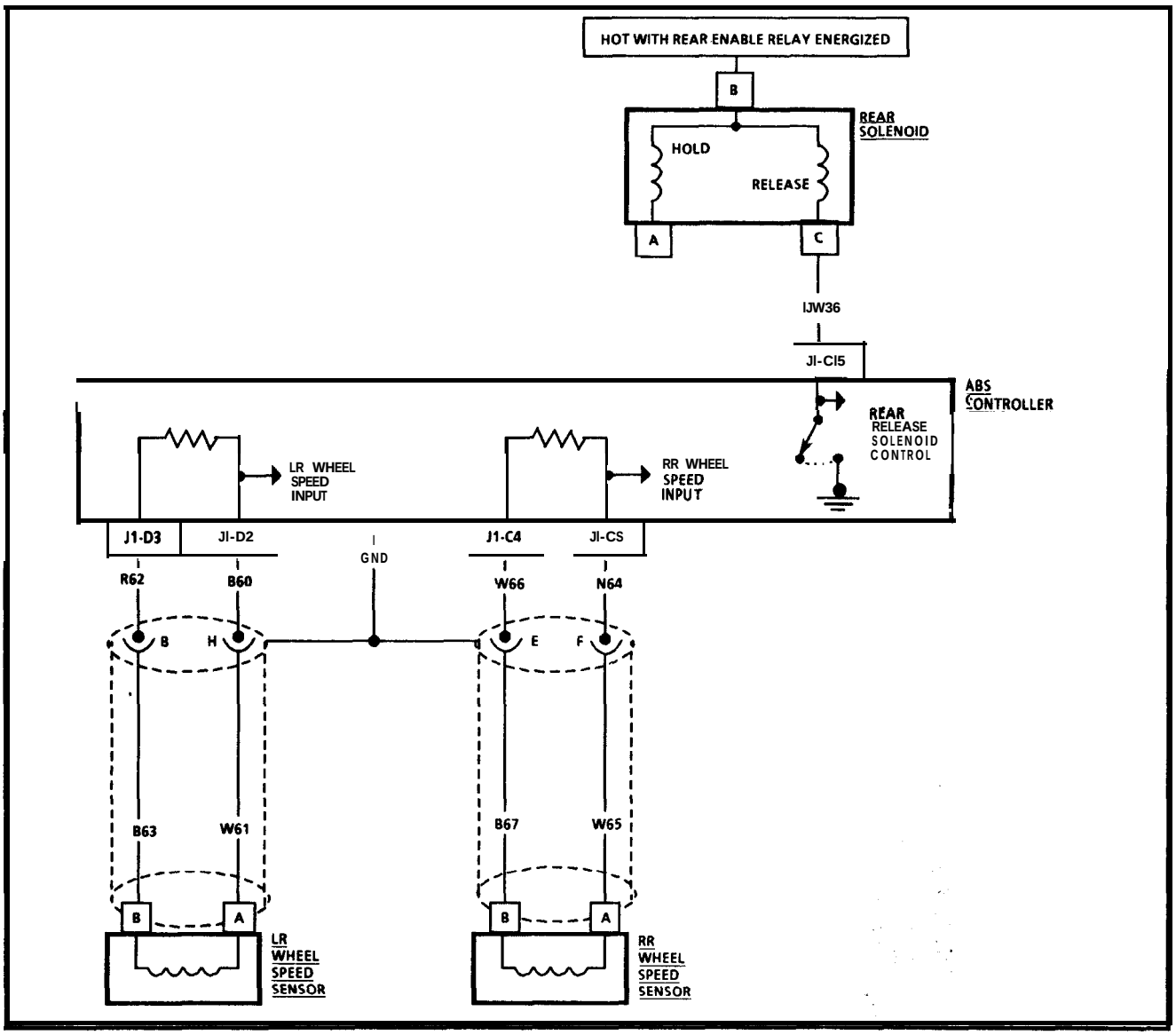
NO

CHECK FOR POSSIBLE INTERMITTENT ELECTRICAL FAULT. CHECK ACCUMULATOR SWITCH AND PUMP MOTOR RELAY FOR GOOD CLEAN TERMINAL CONTACTS. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.

YES

REFER TO HYDRAULIC DIAGNOSIS IN SECTION "JF.13".

AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.



CODE A063

BOTH REAR WHEEL SPEED SENSORS OPEN

The ABS Controller monitors the Wheel Speed Sensors. If one or both rear wheel speeds are zero, the ABS Controller cannot accurately detect wheel lock-up. Since three good wheel speeds are needed to set Codes A046 or A047, these Codes cannot determine if both wheel speed sensors are faulty. Code A063 can detect if both Rear Wheel Speed Sensors are malfunctioning.

CODE A063 will set when all of the following conditions exist:

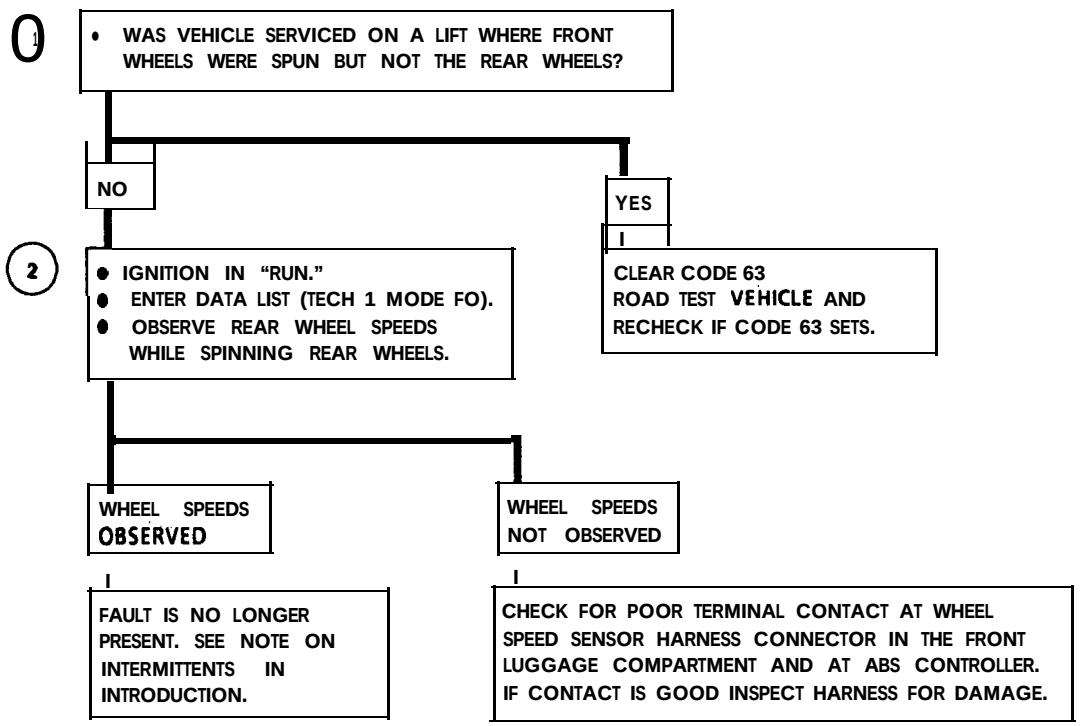
- The ABS Controller senses both front wheel speeds are greater than 10 mph and they are operating correctly.
- The ABS Controller senses both rear wheel speeds are 0 mph for more than 20 seconds.

Test Description: The following provides an explanation of the procedures being followed in the facing trouble tree.

1. If the front wheels were spinning while the vehicle was being serviced on a lift code, A063 would set. The code should be cleared and the vehicle road tested to insure this was the reason code A063 set.
2. Determines whether the fault is due to a hard failure or a possible intermittent failure.

CODE A063

BOTH REAR WHEEL SPEED SENSORS OPEN


1
WAS VEHICLE SERVICED ON A LIFT WHERE FRONT WHEELS WERE SPUN BUT NOT THE REAR WHEELS?
NO
YES
2
IGNITION IN "RUN."
ENTER DATA LIST (TECH 1 MODE FO).
OBSERVE REAR WHEEL SPEEDS WHILE SPINNING REAR WHEELS.
CLEAR CODE 63
ROAD TEST VEHICLE AND RECHECK IF CODE 63 SETS.
WHEEL SPEEDS OBSERVED
WHEEL SPEEDS NOT OBSERVED
FAULT IS NO LONGER PRESENT. SEE NOTE ON INTERMITTENTS IN INTRODUCTION.
CHECK FOR POOR TERMINAL CONTACT AT WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND AT ABS CONTROLLER. IF CONTACT IS GOOD INSPECT HARNESS FOR DAMAGE.

NOTE: IF THE HARNESS BETWEEN THE WHEEL SPEED SENSOR HARNESS CONNECTOR IN THE FRONT LUGGAGE COMPARTMENT AND THE WHEEL SPEED SENSOR IS DEFECTIVE, REPLACE IT. DO NOT ATTEMPT TO REPAIR IT. AN EXPLANATION OF EACH TEST PROCEDURE, REFERENCED BY A CIRCLED NUMBER, IS GIVEN ON THE FACING PAGE. WHEN ALL DIAGNOSIS AND REPAIRS ARE COMPLETE, CLEAR CODES AND VERIFY OPERATION.